ELECTRICAL REVIEW

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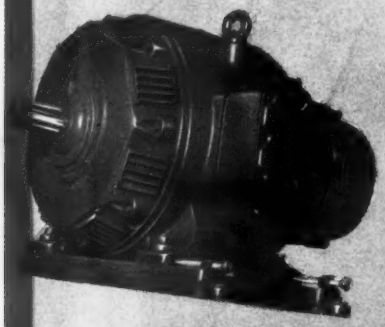

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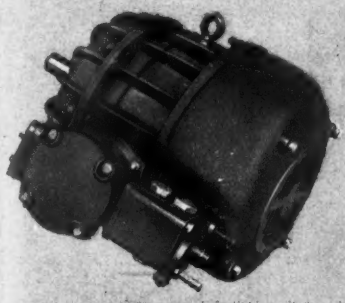

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ELECTRICAL REVIEW

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7 JANUARY 1955

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VOLUME 156 ✧ NUMBER 1

Eighty-Third Year of Publication

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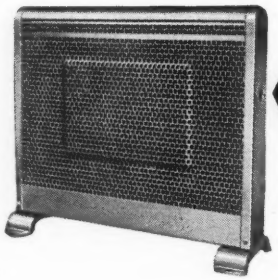

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ELECTRICAL REVIEW

7 January 1955 Vol. 156 No. 1 Established 1872

Outlook for 1955

THE past year was a good one for practically all branches of British industry and particularly for most sections of the electrical industry. Exports were well maintained and the home market expanded—too much according to some economists, although there seemed to be still ample funds for investment.

A slackening in business was experienced by the cable-making industry for a period, one factor being the holding-off of buyers who hoped for a fall in prices when copper was "freed." After an initial decrease, the price of copper rose again far above the previous level and the hesitant buyers were caught. Since then cable business appears to have become more normal.

Conditions in the home market are accurately indicated by the continued expansion of electricity output. The latest available figures show that in the twelve months ended with November last Area Boards' sales rose by 9½ per cent in comparison with those of the preceding twelve months. Lest this should be attributed mainly to improved domestic sales, it may be pointed out that the rise for the eight "industrial" areas was slightly greater than for the others. Domestic development has, of course, gone strongly ahead since the removal of the bans under which it had been placed.

Continuity of electricity supply is still dependent upon the caprices of the weather. Although the situation has improved the British Electricity Authority was again unable to commission all the plant it would have liked to install, but of the permitted 1,450 MW, we believe that over 1,400 MW had been installed by the end of last year. The present Minister of Fuel and Power has a more enlightened policy in this respect than his predecessors but the effects of an earlier shortage of steel are being felt.

It is natural when things are going well to wonder if progress can be maintained or whether there may not be a fairly rapid reversal of the trend. A year or so ago there were fears of an American depression which would have made its effects felt in Europe, but those fears have now receded and recent reports from the United States appear to be fairly confident.

Although the chairmen of all the leading electrical manufacturing companies have agreed that the expansion of the home market is likely to continue, they discern a number of growing adverse influences in overseas countries. While British firms can offer the best quality and most reliable equipment there are competitors whose prices are more attractive, and cost is too often the deciding factor. British exports can therefore be maintained or increased only if their prices can be kept down. Taxation must be eased, efficiency must be raised and greater individual output must accompany any increase in wages. Otherwise we shall slip back and lose markets which will not easily be regained.

ELECTRICAL HONOURS

The principal electrical interest in the New Year Honours lies in the peerage bestowed upon Sir Arnold Gridley for political and public services. Sir Arnold's public services have extended over many years. He was controller of electric power supply in the Ministry of Munitions in the 1914–18 war and he has been active in both the electricity supply and manufacturing fields since the beginning of the century. Electrical manufacturing is also recognized in the knighthood conferred upon Dr. Ivor Cox, managing director of the Metropolitan-Vickers Electrical Co., Ltd., with whom he has served for over forty years; Dr. Cox is also a director of Associated Electrical Industries, Ltd., and several other companies. Among other men in the electrical manufacturing industry who are honoured is Mr. V. W. M. Roberts (B.T.H. Co.) who becomes an O.B.E. Electricity supply is represented in the list by Mr. C. T. Melling, chairman of the Eastern Electricity Board, who is made a C.B.E.; Mr. G. A. Vowles, controller, Yorkshire Division, British Electricity Authority (O.B.E.); and Mr. P. Philip, Dundee area manager, North of Scotland Hydro-Electric Board (O.B.E.). We offer our congratulations to those mentioned and the others included in the extract from the Honours List published in this issue.

COMMENDABLE ACHIEVEMENT

One of the most creditable major repair jobs we have ever heard of is described elsewhere in this issue. It relates to extensive reblading in the low pressure cylinder of the turbine of a 51·5 MW turbo-alternator at the Hams Hall "A" power station of the British Electricity Authority (Midlands Division). Four complete rows of blading on each of the rotors and cylinder were replaced after machining out the blade roots on site, with the rotor in the operating position, by using the rotor of the whole turbo-alternator set as a sort of lathe which was driven by the set's barring gear. In addition, other lesser repairs were carried out and some 10,000 individual crack detection blade tests were conducted; all the work was completed within a total "outage" time of 24 days, working 24 hours a day and seven days per week. This remarkable achievement resulted from the planning and organization of every stage of the work and excellent co-operation between the B.E.A. and representatives of the manufacturers concerned, even though by fortunate chance the necessary new blading happened to be in stock at Hams Hall. We congratulate Mr. F. W. Skelcher, chief generation engineer (operation), Midlands Division, B.E.A., and his staff on an excellent job well done at a difficult time.

ECONOMICAL COOLING TOWERS

The greater quantities of cold water required for condensers in the larger power stations of to-day tend to relegate most rivers, except at estuaries, to the duty of providing make-up water for cooling towers using either natural or mechanical draught. The clarification of the issue of the most suitable spheres for each type (in which station load factor seems a negligible function), having regard to atmospheric conditions in this country, was a valuable feature of the I.E.E. paper by Messrs. G. F. Kennedy and P. H. Margen, reported in this issue. Another and even more important point made by the authors related to the size of modern turbines with associated higher values of full-load heat rejection per sq ft of net exhaust area. This would economically permit of higher cooling water temperatures and the use of smaller towers. The savings estimated to be feasible in this way appear to warrant appreciable modifications of present design.

STEAM AND WATER POWER

Widening experience of hydro-electric schemes has emphasized the value of interconnecting them with thermal power stations, whatever proportion of the total output each contributes. The paper presented last night at the Institution of Electrical Engineers by Messrs. T. G. N. Haldane and Mr. P. L. Blackstone dealt more especially with hydro stations normally operated at low load factors, by which heavy expenditure on water storage can be lessened. The importance of such stations is likely to increase because, while technological advances in high-voltage transmission have made possible the utilization of remote water resources, these generally are of small magnitude in Europe in comparison with the growth of load, thus necessitating increasing dependence on thermal or, eventually, nuclear power stations.

POWER STATION COSTS

It is, and has been for some years, a constant cry of the critics that the capital costs involved in aiming at higher efficiencies for power station equipment are too great, or that the increases in efficiency obtainable are too low to justify the expenditure. On the surface the criticism in many cases appears to be sound, but consideration of two very practical points may lead to a somewhat different conclusion. Once a certain efficiency increase is assured, no matter how small or large, it is only a matter of mathematics to prove whether or not the expense involved is justified, or whether the balance sheet is sound. Further, the results of the efforts of managers and engineers to improve efficiency over a period of time are cumulative.

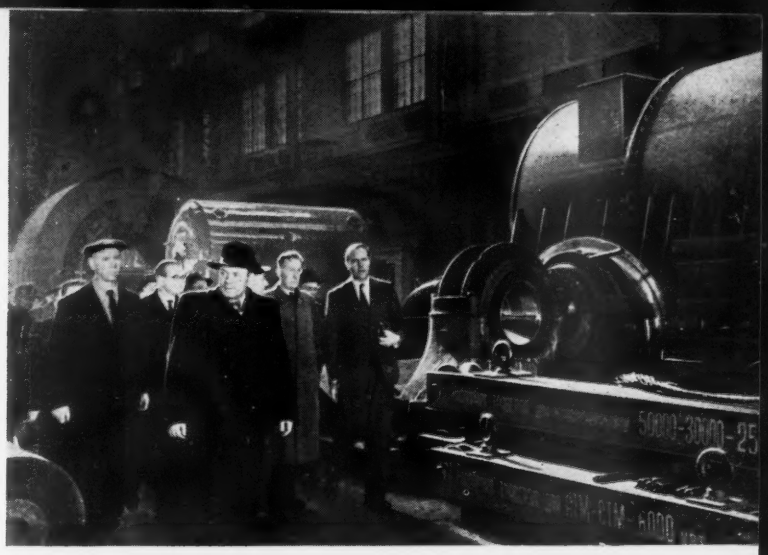
ELECTRIC IRONS

Continuing our series of illustrated surveys of domestic electrical appliances, next week (14th January) we shall be dealing with electric irons. Included in the particulars to be given in tabular form will be details of the type, weight, loading, special features, finish and price. As the demand for this particular issue of the *Electrical Review* is likely to be heavy, orders for additional copies should be placed without delay. In the next survey (4th February) the subject will be electric kettles

RUSSIAN VISIT

Glimpses of Some Electrical Developments

By F. J. ERROLL, A.M.I.E.E., M.P.

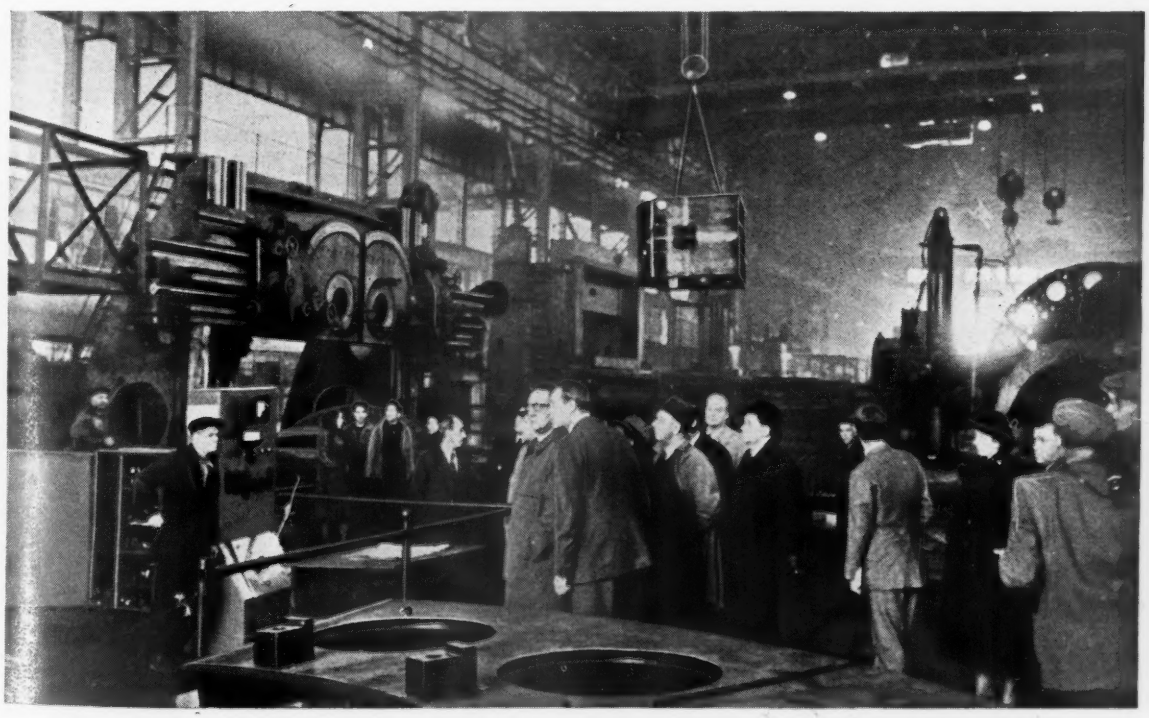


Led by the works manager and the shop superintendent, the Parliamentary Delegation walks through the heavy generating plant assembly shop of the Electrosilia-Kirov Works. The author is seen on the right of the photograph

THE Parliamentary Delegation which visited Russia this autumn was the first for almost ten years to be invited by the rulers of the Soviet Union. We were able to spend only seventeen days in the country but during this time we had an opportunity of staying in several of Russia's major cities, including Moscow, Stalingrad, Leningrad, Sverdlovsk and Gorki. Our Russian hosts had drafted out a programme for us but they made it plain that they would welcome suggestions and do their best to include them in the itinerary. Accordingly I prepared and submitted to them a list of plants and installations which in the time available would enable me to form some sort of impression of industrial development in Russia to-day. The list included machine tool factories, a power station, a gold mine, a plant manufacturing heavy electrical equipment, the port installation at Leningrad, and an aircraft works. By the end of my visit I had been given facilities for seeing an example of every item on the list.

It is fair to say that in electrical matters Russia has made progress comparable with other aspects of her industrial development. As is well known, the succession of Five Year Plans placed particular emphasis on the development of heavy industry, and although the production of consumer goods is now receiving greater attention the extension of heavy industry continues unabated. The Russians are making full use of what can be learnt from the industrialized countries of the West. Lenin said in " The Impending Catastrophe ":—" We do not invent, we take ready made from capitalism: the best factories, experimental stations and academies: we need adopt only the best models furnished by the experience of the most advanced countries." This dictum is still faithfully followed; but now in certain directions Russian engineers,

Machining stator components for turbo-generator sets at the Electrosilia-Kirov Works



doubtless aided by German designers from Eastern Germany, are able to develop their own engineering techniques and advanced industrial design.

While in Leningrad I was taken round the Electrosilia-Kirov Works. This works specializes in the manufacture of heavy electrical plant. On my arrival the works director mentioned that his works had received considerable assistance from Metropolitan-Vickers before the war which had enabled them to develop and expand. He also acknowledged the help given to Russian technicians during their pre-war visits to Manchester and London. He said that so far as he knew no one from Manchester had visited the works since the war.

The works director said that the output of turbine-driven generators was running at the rate of 1·5 million kW a year, and of hydro-electric generators at the rate of 1 million kW a year. There was in addition an annual output of about a thousand medium sized generators, totalling approximately 1 million kW, as well as a substantial production of small and medium sized motors. The generators (both turbo and hydro) are manufactured up to 150,000 kW in size, and in addition to rolling mill equipment motors and generators are made from 150 kW upwards.

This output is achieved by 10,000 employees of whom about 55 per cent are women. The average wage is of the order of 1,000 roubles a month, maximum earnings, however, reaching 2,000 roubles a month. The works director was frank about his own salary; he said that he received a basic payment of 5,000 roubles monthly and could earn an output bonus up to an additional 5,000 roubles a month.

The figures quoted above are those that were given to me. There was the added difficulty of interpretation. So far as I was able to ascertain our interpreters did their best to translate accurately and faithfully, but of course when technical subjects were under discussion the interpreters were sometimes put to considerable difficulty.

As regards the rate of exchange, the official figure is 11·2 roubles to the pound, so that a wage of 1,000 roubles a month is approximately equal to £89, while the works director's salary and maximum bonus together would amount to nearly £900 a month. In terms of purchasing power, however, a conservative figure is 40 roubles to the pound, which would make the effective wage £25 a month, or about £6 per week, and the salary £250 a month, or £3,000 a year. Income tax rises to 19 per cent.

I made a point of asking the works director if the works was experiencing any delays in production owing to shortages of raw materials, particularly copper. The reply I received was to the effect that production increased every year by 25 per cent. Copper comes to the works from plants in Leningrad, Kiev and Moscow.

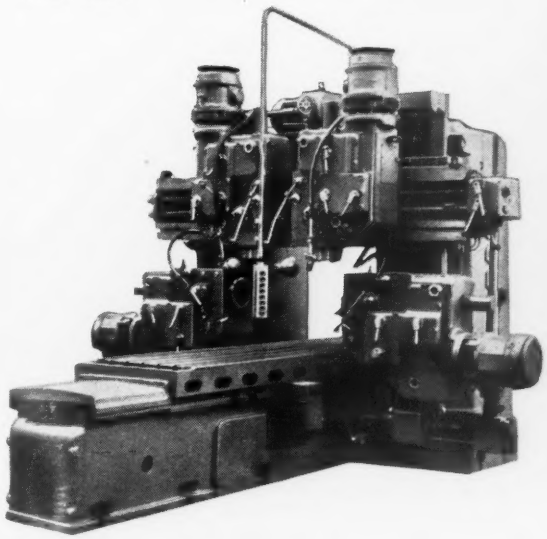
During a short tour of the works I was given an opportunity of seeing the main fabricating shop and the principal assembly shop for heavy generating equipment. Amongst the equipment awaiting dispatch was the stator of a 150,000 kW hydro-electric set, comprising six segments each weighing 62·5 tons, for the new station at Kuibyshev. There was also a 120,000 kW stator for a turbo-generator set, mounted on a railway truck for dispatch. I was told that the set was being sent to the new station at Kuibyshev.

At one end of the main assembly shop I was shown lathes for rough turning the rotor forgings for turbo sets. Two of the lathes had been made in Great Britain, but the third had been manufactured in Russia since the war and was similar in many respects to the imported equipment. The strategic ban on the export of certain machine tools may have slowed down the pace of Russia's industrial development, but on the other hand it has compelled Russian engineers to make for themselves what they had previously thought was beyond them.

During my visit to a modern gold mine near Sverdlovsk on the eastern side of the Urals I was able to see the extent to which electricity is employed underground by the Russians. The main shaft was sunk in 1951 and the principal output is from a level at 112 metres below the surface. Underground haulage is by electric locomotives getting their power from overhead lines or batteries. The substation at the working level was commodious and well equipped. Russian-made mercury arc rectifiers were installed to provide power for the haulage system, and here too were to be found the transformers and switchgear for supplying the motors driving the mine pumps. A woman was in charge of this substation; she had obtained her

Steel forging for a turbine rotor being rough machined in a Russian-made lathe in the Electrosilia-Kirov Works

Heavy multiple planing machine made at the Frazernich-Stankov Works



The "Victory" car assembly line at the Molotov Vehicle Works, Gorki

technical degree at the neighbouring university. I saw many other women working underground but none actually at the working face.

Both at Gorki and Moscow there was an opportunity of seeing the manufacture of Russian machine tools. The Red Proletariat Works in Moscow specializes in the production of a general-purpose lathe on mass production lines. This works also produces a number of special machine tools for the motor vehicle industry and the steel industry. At Gorki I visited the Frazernich-Stankov Works which manufactures milling machines and a wide range of individual heavy-purpose machine tools. The latter have individual motor drives and a full range of push button controls.

In Moscow I was taken to see the Teplow power station. This station was built before the war and further developments, delayed by the war, have since taken place. Our hosts had selected this station for a visit as it was neither one of Moscow's oldest stations nor one of the newest—it represented in their view a good average, and was not intended to be a show place. The installed capacity is 125,000 kW, consisting of five 25,000 kW 11 kV 3,000 r.p.m. turbo-generator sets. According to the superintendent the station generates 900 million kWh a year. A linked network of hydro and steam stations in the Moscow area helps to even out the load. Energy is transformed up to 115 kV for the grid, while distribution to Moscow substations in the vicinity is at 33 kV.

The turbo sets had the following dates on their baseplates: 1933, 1935, 1937, 1946 and 1951. The latest machine had been made by the Ural Turbine Works, near Sverdlovsk, and all the other sets had been made in Russia, too. In fact it was pointed out to me with evident pride that all the equipment had been made in Russia.

The boilers are fired with pulverized fuel and each has a capacity of 230 tons of steam per hour. The pre-war boilers operate at 30 kg/sq cm (427 lb/sq in) pressure, and at a temperature of 400 deg C. The latest post-war boiler operates at 100 kg/sq cm (1,422 lb/sq in) and 510 deg C.

I was told that the calorific value of the fuel used was 6,300 calories/kg and its ash content 17 per cent. The superintendent said that the fuel consumed worked out at 480 grammes/kWh in summer, and 360 grammes in winter. Incorporated in the station is a district heating scheme which, of course, operates only during the winter.

As will be readily appreciated, it was difficult to expect an interpreter trained in the study of British Commonwealth affairs to translate accurately questions and answers relating to electrical matters, and the figures given above should therefore be treated with that in mind.

A short tour of the station showed that the Russian engineers had worked to an excellent layout and the station generally compared favourably with stations of similar age to be found in other countries. The control room was luxurious compared with British standards. The whole of one wall was taken up with a vast portrait of Stalin in colour. Amongst the control room staff were two women.

The visit to the station over, the superintendent hurried me back to his office, "To answer your further questions, if any," as he rather stiffly said. But in fact the object was to remove the corks from some bottles of excellent Soviet champagne and to drink toasts to "Peace" and "Friendship between the engineers of the world."

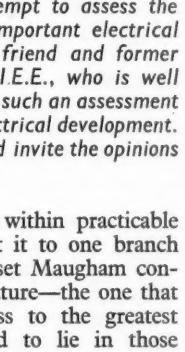
A view of the Moscow underground railway

10 ELECTRICAL MILESTONES

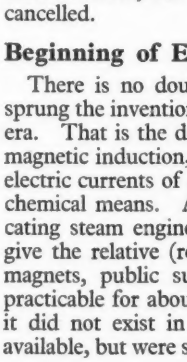
LANDMARKS SINCE FARADAY

THE choice and subsequent appreciation of the world's ten greatest novels made by Mr. W. Somerset Maugham and recently published in a series of articles in the Sunday Times *prompted thoughts about an attempt to assess the value of a similar number of the most important electrical inventions. We therefore invited our friend and former Technical Editor Mr. C. O. Brettelle, M.I.E.E., who is well qualified for the task, to apply himself to such an assessment of the ten outstanding contributions to electrical development. Here, therefore, we present his views and invite the opinions of readers on his choice.*

TO keep the scope of this inquiry within practicable limits it has been necessary to restrict it to one branch of the vast subject, just as Mr. Somerset Maugham confined his attention to one form of literature—the one that probably brings the greatest happiness to the greatest number. The closest analogy seemed to lie in those inventions that have done most to bring the public supply of electricity to its present stage of general use in this country.



Michael Faraday



Sir Joseph Swan

Col. R. E. Crompton

Thomas Alva Edison

It soon became apparent that the parallel could not be drawn very far. A work of imaginative literature is a finished entity, readily recognizable as the product of one author, whereas an engineering invention is a fresh application of an established scientific discovery within the framework of undeviating physical laws. It is not only legitimate but also incumbent upon later comers to exploit the initial discovery to the fullest extent and to improve previous methods of application. Questions of economics, which are only indirectly relevant in literature, are by definition an essential part of the fabric of engineering.

In any age more than one scientist or engineer is likely to be near to arriving at the same fundamental theory or to working it out in practice. Credit generally goes to the man who realizes its implications and possesses the ability to enunciate in definite form what may be merely a vague idea in the minds of others. The difficulty of ascribing a step forward to any one inventor has progressively increased with the modern recognition of the importance of applied research, in which most of the patents taken out relate to minor although perhaps vitally important components. A feature of this research is that it is usually due to anonymous patient investigations of many co-operating minds in which, incidentally, many a beautiful hypothesis is killed by an ugly fact. Those engaged on it have often improved earlier concepts almost out of recognition to meet unfolding modern needs, but the debt to the pioneers is not thereby cancelled.

Beginning of Electrical Era

There is no doubt about the source from which have sprung the inventions that have brought about the electrical era. That is the discovery by Faraday in 1831 of electromagnetic induction, which made possible the generation of electric currents of a magnitude not producible by electrochemical means. Although generators driven by reciprocating steam engines were built in the following years to give the relative (rotary) motion between conductors and magnets, public supplies of electricity did not become practicable for about half a century, since means for using it did not exist in the requisite form. Arc lamps were available, but were suitable for little more than the illumination of large open spaces. The "sub-division of the electric light" requisite for the general user came only with Swan's invention in 1878 of the carbon-filament lamp.

Statutory regulation of distribution followed in 1882, but the framers of what became the first Electric Lighting Act could hardly have been expected to gauge the ultimate possibilities of the new force. Within the restrictions imposed by the Act and by the technical knowledge available at the time, the direct current system, with which the names of Crompton and, of course, Edison, are pre-eminently associated, was in general use. Direct current having served its initial purpose was gradually superseded by alternating current.

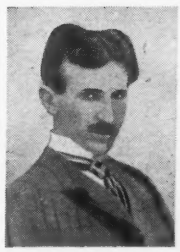
Ferranti's Foresight

At that time only Ferranti had both the ability to foresee the potentialities of electricity and the practical aptitude to justify his faith by works. His basic principle was the one now accepted throughout the world. It was that generation should be carried out in a relatively few power stations (instead of in many small local ones) on sites outside large towns where land was cheaper and where coal and water were more easily obtainable. This entailed transmission at high voltage to centres of population, there to be transformed to lower voltages for distribution to consumers.

To achieve this alternating current was necessary, but as no electrical plant or cables of the requisite capacity and voltage existed in 1885, Ferranti had to design his

Dr. S. Z. de Ferranti

Sir Charles Parsons



Nikola Tesla

Charles H. Merz

H. W. Clothier

own when he laid out the prototype Deptford station, which was started up in 1891. Although the 1,000 kW alternators embodied a well known principle, their large output and their high-voltage insulation represented a great advance on any machines previously thought of. His transformers, arranged for parallel operation, were certainly an innovation though the basic idea was implicit in Faraday's discovery. Even more strikingly original was his 10 kV cable, eight miles in length, which he manufactured with its joints and laid to the West End, to remain in service for over forty years. It was the first cable to be insulated with impregnated lapped paper.

Logical development of Ferranti's ideas were delayed by lack of a prime-mover of low enough weight and cubic capacity for the required horse power until Parsons designed the first turbo-alternator (the first successful turbine having been built by him in 1884). The turbine's most immediately obvious merits, as compared with the reciprocating engine, were that it made possible a large kW output in a much smaller space, produced uniform torque and almost eliminated vibration. He also designed the high-speed alternator to match the turbine.

Two further developments made the use of alternating current ultimately inevitable on the three-phase system (rather than on the single-phase system with which it started). One was the invention (ascribed to Tesla in 1888) of the incomparable three-phase squirrel-cage induction motor—robust, simple and free from commutator troubles. Associated with this invention was the three-phase four-wire system for medium voltage, with its important copper economy, which was introduced into this country on Tyneside about the turn of the century. This was done by Merz, whose pioneer work on the North East Coast, more particularly in the interconnection of large power stations (including centralized control of load sharing) and high-voltage transmission, created an embryonic grid. There also steam reheating between turbine cylinders was initiated after the first world war.

A further inducement to the use of three-phase current came nearly fifty years ago in the invention of the Merz-Price discriminative balanced protective gear. The construction of the British grid (under the Act of 1926), the first to be pre-planned as a nation-wide system, was based on many inventions and other earlier developments, but the use of 132 kV and the interconnection of station busbars brought to the fore a large number of hitherto unsolved problems.

Among the difficulties encountered was that of securing proved ratings of circuit breakers capable of rupturing the heavy short-circuit currents that might occur in view of the massed effect of numerous power stations feeding the grid. This was overcome by the building of several high-voltage testing stations—the first in 1929 under the direction of Clothier—which have also furnished essential information on the phenomena of the arc. Another need was to provide 132 kV cables for short distances that would eliminate ionization of air pockets in the dielectric as the most notable hazard. This had been done for 33 kV cables a few years before, primarily by Hochstadter whose metallized paper sheath over individual cores turned tangential into radial electric stresses, but the value of oil or inert gas under mechanical pressure to iron out voids and to permit of higher electrical stress per cm in the dielectric was quickly realized in half a dozen different designs which have now been adapted to meet conditions at 275 kV.

The success that has attended the almost entire use of overhead lines for the long spans of the grid is mainly owing to improvements in such details as anti-fog insulators and anti-vibration dampers and to the attention paid to reducing corona losses and interference with communication. Similar evolutionary advances in transformer design have made the big ratings of to-day feasible, particularly having regard to the transport of units of the large MVA capacities required.

Finally there is the instrument which forms the basis of the economic aspect of electricity supply in relation to the majority of consumers. That is the single-phase induction watt-hour meter, which appears to owe most to Ferranti's work before 1895.

From the foregoing applications of electrical science, all of which contributed in a major degree to bringing Faraday's discovery of electro-magnetism into the service of man on the scale known to-day, the following ten are tentatively put forward in more or less chronological order as the most significant:

1. **Filament lamps;**
2. **The Deptford 10 kV cable;**
3. **High-voltage transformers;**
4. **Three-phase induction motors;**
5. **Three-phase four-wire distribution;**
6. **Single-phase watt-hour meters;**
7. **Turbo-alternators;**
8. **Differential protective gear;**
9. **Circuit breaker testing;**
10. **Elimination of ionizable voids in high-voltage cable insulation.**

The list of course lays itself open to differences of opinion and the views of readers will be welcomed.—C.O.B.

"Packaged" Atomic Power Plant

The *Economist* reports that the American Atomic Energy Commission has awarded to the American Locomotive Company a contract to design and build the prototype of a small "packaged" nuclear power plant that can be transported by air. It will be financed jointly by the Army and the A.E.C. and will cost slightly over $2 million for a power output of 2,000 kW. The reactor will be of conventional design, using highly enriched uranium as a fuel, and moderated and cooled by ordinary water under pressure. This type, although it is expected to be less economic than other more advanced types under development, was selected because it can be built with existing technology. The reactor is expected to take only three years to build.

Hydro-Electric and Thermal Systems

Survey of World Development

PROBLEMS arising in the planning and development of systems comprising both thermal and hydro-electric plant were discussed by Messrs. T. G. N. Haldane and P. L. Blackstone in a paper submitted at a joint meeting on 6th January of the Institutions of Electrical and Civil Engineers.

During the last quarter of a century, the authors stated, world development of hydro-electric resources had increased four-fold and installed capacity now was estimated at 90 million kW. Expenditure on storage usually formed a large proportion of the total cost of a hydro-electric installation, the amount per kW decreasing as the installed capacity increased. Usually the incremental cost of such increase, including larger conduits and transmission, was less than that for thermal stations. Where thermal capacity predominated water power capacity should be developed as fully as was economically justifiable, which also reduced waste through spilling. In determining the installed capacity, daily and not seasonal duration curves were necessary.

PERCENTAGES OF THERMAL AND HYDRO-ELECTRIC PLANT IN VARIOUS COUNTRIES*

	Thermal	Hydro-electric		Thermal	Hydro-electric
United Kingdom	96·5	3·5	Japan	37·4	62·6
Australia ...	88·1	11·9	Sweden ...	22·7	77·3
Germany (Western)	81·1	18·9	Italy	18·3	81·7
United States ...	77·8	22·2	New Zealand...	11·5	88·5
France	55·5	44·5	Canada ...	9·6	90·4
Finland	39·8	60·2	Switzerland ...	6·6	93·4
			Norway ...	4·2	95·8

*Source: United Nations Bulletin of Statistics, November, 1953.

Hydro plant had higher availability and flexibility than thermal plant; it could be started, synchronized and brought up to full load much more quickly. The 102 MW of the Galloway scheme (in eleven machines) took only 15 min, even with empty penstocks and turbine casings.

For a low-head power station at the foot of a dam, foundations, short penstock and intake and building extensions might be constructed without difficulty when installing further machines. At higher heads the cost of a new tunnel and pipe line, if the sizes were originally adequate only for the initial capacity, might prevent a later addition to the plant.

Firm output (i.e. that guaranteed for the driest year) depended on the storage provided, but for any particular reservoir site there would be a proportion that could not be economically exceeded by increasing the size of the dam. Thermal power as a means of increasing firm water power might be justified. A relatively new alternative was presented by storage pumps with a tail-race pond to be operated by off-peak energy. The cost per kWh supplied for pumping (perhaps infrequent), allowing for 33⅓ per cent losses, would be less than the value of the stored energy sold during peak hours. The heavier cost of a reversible pump turbine (particulars of which were given), which might be one set in an otherwise conventional multi-unit station, would be offset by avoidance of expenditure on a separate pump, penstock and building.

Artificial low load factor conditions could be provided by a full pumped-storage scheme. In this the pumps were run during nights and perhaps week-ends to put back from a tail-pond the water used during generating periods. Where no surplus water was available, the pumping energy had to be supplied from the less economical thermal stations at about two-thirds of the efficiency of direct generation. Over a long period pumped storage would almost certainly be advantageous if its capital cost were less than that of new thermal plant, bearing in mind that sinking fund charges were less for hydro-electric stations. Estimates for a storage project in Great Britain were worked out in an appendix to the paper.

Surplus water power from the new Adam Beck power station below the Niagara Falls was being raised to an artificial reservoir by reversible pump-turbines which would produce 220 MW during peak loads. The water would be used a second time in the main station, where 300 MW of peak-load-only plant was installed, making its total capacity 1,200 MW.

The high capital cost of nuclear power stations would limit their operation to providing base loads, thus favouring the development of relatively low-load-factor hydro-stations. In view of the tendency of world prices to continue to rise, long-life hydro-stations (particularly in regard to civil engineering works) had a financial advantage over short-life thermal stations.

Turbine Design

The fundamental design of hydraulic turbines had not changed significantly since the introduction of the movable-blade Kaplan machine more than 30 years ago. Present efficiencies were about 93 per cent for (low-head) Kaplan, 92 per cent for (medium-head) Francis and 91 per cent for (high-head) Pelton turbines. Outputs had been stepped up to 165,000 b.h.p. (Francis) at Grand Coulee, and 111,000 b.h.p. (Kaplan) at McNary Dam. Orders for Francis turbines of British design (175,000 b.h.p.) had recently been placed by the Quebec H.E. Commission. Single-jet twin-runner Pelton units of 150,000 b.h.p. were being built for Cimego power-station in the Alps and four-jet single-runner vertical impulse machines of about the same output were being installed in Kemano station, British Columbia.

Higher heads and speeds had been made possible by the use of materials, such as aluminium bronze (10 per cent Al and 1 per cent Fe), which had better resistance to cavitation and corrosion, and of improved blade profiles. No major change in mechanical design of governors seemed likely, but on an interconnected system the function had become that of a frequency-power regulator capable of control by any of several quantities. A governor developed in Sweden embodied an electronic-valve regulator to operate the relay valve of the turbine servo-motor instead of the normal pendulum-operated linkage.

Large base-load plants would probably continue to be staffed and manually or semi-automatically controlled, but fully automatic remote control would no doubt be extended, especially for plants situated in intractable country. The initial cost of thermal power could be closely estimated, but future cost was subject to unpredictable future variations, such as in the price of coal, whereas for hydro-electric installations, while the capital cost varied widely in individual cases, thereafter it remained virtually constant.

Chlorinated Diphenyls

Their Dielectric Properties and Significance in Capacitor Applications

By P. D. WILMOT, B.Sc.*

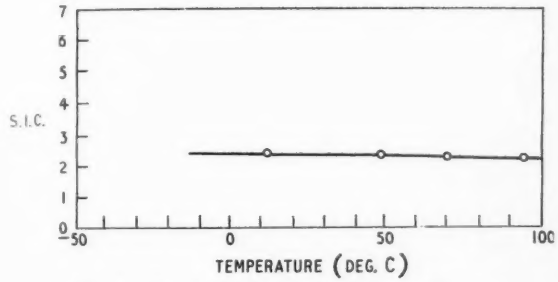


Fig. 1.—Capacitor oil s.i.c. at 60 c/s and 1,000 c/s

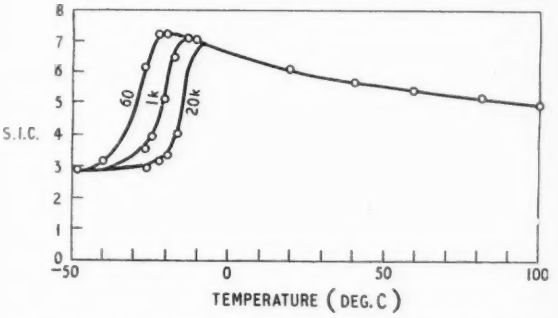


Fig. 2.—"Aroclor" 1242 s.i.c. at 60 c/s, 1,000 c/s and 20 kc/s

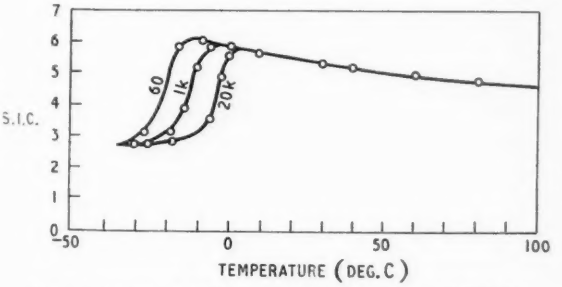


Fig. 3.—"Aroclor" 1248 s.i.c. at 60 c/s, 1,000 c/s and 20 kc/s

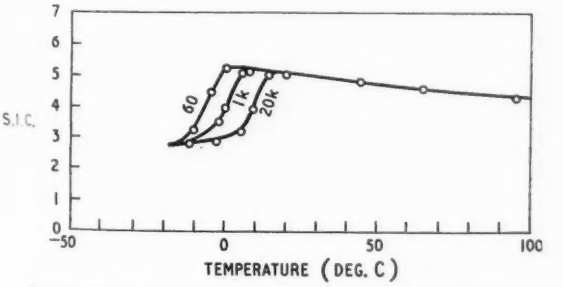


Fig. 4.—"Aroclor" 1254 s.i.c. at 60 c/s, 1,000 c/s and 20 kc/s

IN America, where they have been produced for many years, chlorinated diphenyls have largely supplanted mineral oil as an impregnant for power capacitors. Under the registered trade mark "Aroclor" they are now produced by Monsanto Chemicals, Ltd., in the United Kingdom.[1] Four of these chlorinated diphenyls are of particular interest as dielectrics:—"Aroclor" 1242, 1248, 1254 and 1260. The last two figures of the code number denote the percentage of chlorine by weight which is present.

"Aroclors" are fluids at normal temperatures and their viscosities increase with chlorine content. The four types mentioned above and a typical mineral oil used in capacitors have been subjected to systematic electrical examination, and the results are reported in this article. Similar measurements on the American materials were carried out in 1933 by White and Morgan,[2] and it has been established in these measurements that the British material has the same essential characteristics as the American.

Dielectric Properties Measured

The dielectric properties of primary importance with a.c. capacitor impregnants are specific inductive capacity (s.i.c.), power factor and breakdown strength. The first two properties were simultaneously measured at 60 c/s, 1,000 c/s and 20 kc/s using a Schering bridge. Measurements were made over a temperature range from below the pour points to 100 deg C, so that the temperature characteristics of s.i.c. and power factor could be graphed. These are shown in Figs. 1 to 10. Breakdown voltages were measured over a range of temperatures using 0·5in diameter spheres separated by a gap of 3 mm. These results are set out in Table 2.

A study of Figs. 1 to 5 shows that for a wide range of temperatures the s.i.c.'s of the "Aroclors" are considerably higher than those of mineral oil. At low temperatures both the "Aroclors" and mineral oil have s.i.c.'s between 2 and 3. As temperature increases the figure for mineral oil decreases slightly. On the other hand with increasing temperature the s.i.c.'s of the "Aroclors" undergo rapid increases at temperatures depending on the chlorine content of the "Aroclor" and the frequency of the measuring current; a maximum value, again dependent

*Monsanto Chemicals, Ltd.

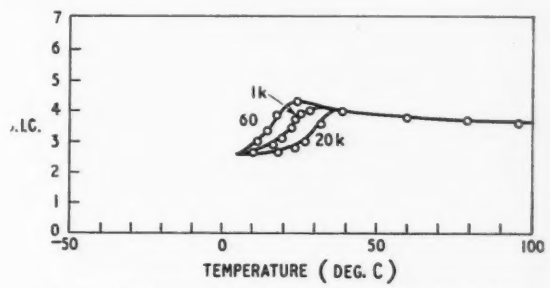


Fig. 5.—"Aroclor" 1260 s.i.c. at 60 c/s, 1,000 c/s and 20 kc/s

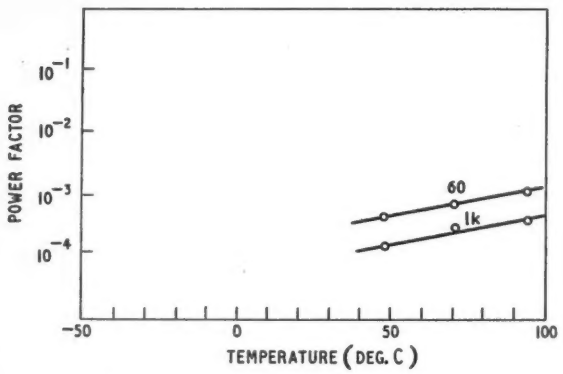


Fig. 6.—Capacitor oil power factor at 60 c/s and 1,000 c/s

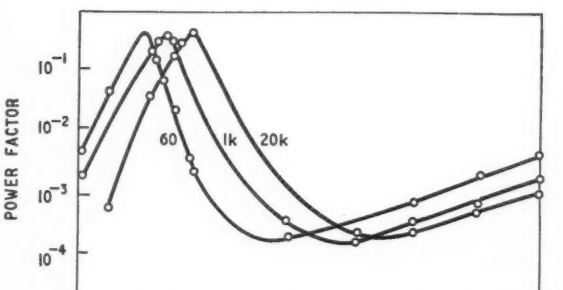


Fig. 7.—"Aroclor" 1242 power factor at 60 c/s, 1,000 c/s and 20 kc/s

on chlorine content and frequency, is reached and thereafter the figures fall off slightly with increasing temperature.

The explanation of this difference in behaviour is that the "Aroclors" are polar and mineral oil is not. A theory of the behaviour of polar materials that satisfactorily explains the essential features of these results has been propounded by Debye[4] and polar materials in general have received a full treatment in a recent book by Frohlich.[5] In both substances the electrons of the molecules are displaced in relation to the nuclei to produce induced dipoles which alone will bring about an s.i.c. of between 2 and 3. The s.i.c.'s of the "Aroclors" are higher than this, since there is also a contribution to s.i.c. from molecular dipoles. These molecules are aligned in the a.c. field, but as the temperature drops the "Aroclor" becomes more viscous and a longer time is required for the molecules to be turned against the forces of internal friction. Eventually, therefore, the point is reached where no alignment can occur, and at this stage only the electronic component of s.i.c. remains. The temperature at which this occurs depends on frequency. The slight fall in s.i.c. that occurs as temperature increases is due to thermal expansion of the fluids, but this decrease is emphasized with the "Aroclors" by the tendency for thermal agitation to reduce the alignment of the dipoles; this accounts for the rather greater rates of decrease with the "Aroclors" in these parts of the graphs.

The polarity of the "Aroclor" molecules arises from the presence of chlorine atoms. Diphenyl itself is non-polar and the hydrogen atoms around the carbon rings possess only single electrons which they pass to the carbon in the molecule. Chlorine, on the other hand, is electro

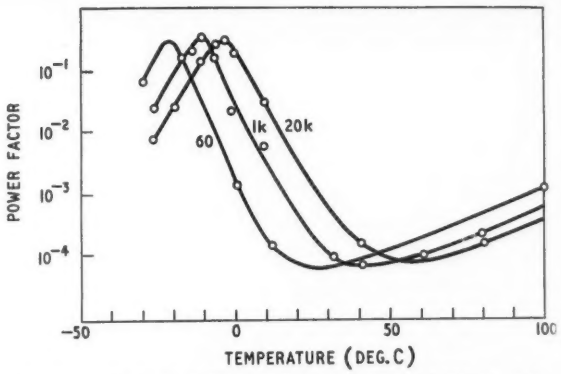


Fig. 8.—"Aroclor" 1248 power factor at 60 c/s, 1,000 c/s and 20 kc/s

negative and takes an electron from the carbon. When, therefore, chlorine is asymmetrically placed in relation to hydrogen around the diphenyl nucleus there is a displacement of the negative charge of the molecule relative to the positive charge and hence a resultant dipole. "Aroclor" 1242, which is principally trichlordiphenyl, has the greatest degree of asymmetry, and "Aroclor" 1260 (hexachlordiphenyl) the least. This explains why the former gives the highest peak s.i.c.

Figs. 6 to 10 give the power factors obtained from the same bridge balance measurements. Again, the chlorinated diphenyls behave differently from mineral oils, for their power factor/temperature curves describe resonance peaks, the peaks occurring at the temperatures at which the s.i.c.'s reach half values between s.i.c.'s at low temperatures and peak values. In these regions the periods of time required to rotate the dipoles against internal friction are of the same order as the periods of the applied voltages. Thus resonances occur. The temperatures of resonance are frequency dependent; such peaks cannot occur with a non-polar substance, such as mineral oil.

In these measurements the temperature range has been extended to higher temperatures than White and Morgan[2] employed. Above the resonance region power factors rise in the same way for both types of fluid. This is due to ionic conduction, and is greater for the chlorinated diphenyls.

Pour points measured by the A.S.T.M. method have been listed in Table 1. It is seen that these temperatures

TABLE 1.—POUR POINTS

Material	Deg C	Material	Deg C
"Aroclor" 1242	−19	"Aroclor" 1254	10
"Aroclor" 1248	− 7	"Aroclor" 1260	31

lie near the peaks of the s.i.c. curves, and this shows that the solidification of the fluid and the phenomena of maximum dielectric loss and fall in s.i.c. are related.

Application to Capacitors

Impregnated paper capacitors are two component dielectric systems with paper "sandwiched" between impregnant layers. Thus the paper also contributes much to the resultant s.i.c. Since the cellulose of the paper has an s.i.c. of between six and seven, a much greater uniformity of stress is achieved in working with "Aroclors," and this improves the capacitor performance. On the other hand, the increase in the resultant s.i.c. of the two component system through changing from mineral oil to "Aroclor" is less than if only impregnant were present. Nevertheless, economies in size of 40 per cent have been

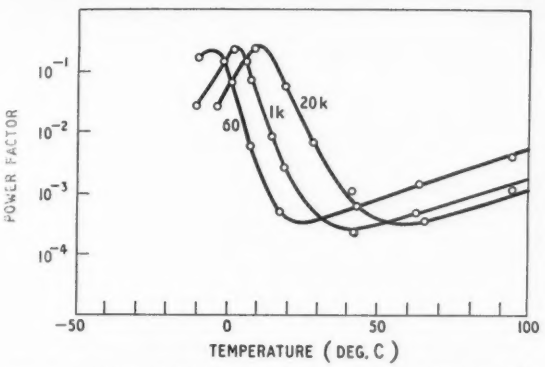


Fig. 9.—"Aroclor" 1254 power factor at 60 c/s, 1,000 c/s and 20 kc/s

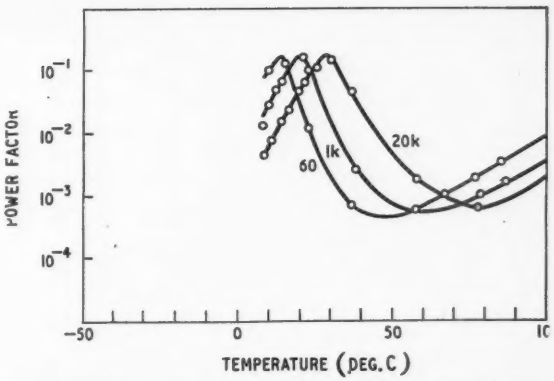


Fig. 10.—"Aroclor" 1260 power factor at 60 c/s, 1,000 c/s and 20 kc/s

achieved by using "Aroclor" in capacitors of a given rating.

At lower temperatures there is the disadvantage that the s.i.c.'s of the chlorinated diphenyls drop to low values. This effect is considerably reduced by the paper, but to achieve high capacitance over a wide temperature range, "Aroclor" 1242 may be used; the temperature range may be still further extended by mixing the "Aroclor" with trichlorobenzene, the effect of which is shown in Fig. 2. However, "Aroclor" 1254 is adequate for most applications, and even if the ambient temperature drops below the region of high s.i.c. the heat dissipated in the capacitor due to dielectric losses will be large enough to keep the temperature of the dielectric in the high s.i.c. range. The same applies to cold start up for, after a short period of operation, the capacitor heats up and regains its normal capacitance value.

The "Aroclors" have higher power factors in the upper range of temperatures. This is due to ionic impurity, and is to be expected since foreign material will more readily ionize in a fluid of higher s.i.c. However, work by Garton[6] and others has shown that for the high fields and small spacings that occur in capacitors the ionic power factor of the impregnant is unimportant.

As has already been pointed out, the paper and the impregnant are disposed in layers in the system, and Endicott[7] has examined two component dielectrics of such a type. By simple theory the power factor of the capacitor is then expressed as follows:—

$$\frac{\theta p \epsilon_i' \epsilon''_p + \theta i \epsilon' p \epsilon''_i}{\theta p \epsilon'_i + \theta i \epsilon'_p}$$

Here θ denotes volume fraction of dielectric, ϵ' is the s.i.c., and ϵ'' is the power factor. The inferiors p and i refer to "paper" and "impregnant." This has been verified by Coquillon.[8] Even with the near zero value for ϵ''_i on Garton's theory the resultant power factor of a capacitor is still higher for impregnants of higher s.i.c. A well-constructed "Aroclor" capacitor should, nevertheless, have a power factor of 0·003 (0·3 per cent) or less at room temperature.

Breakdown Strength

In capacitors the stress is higher than in any other form of electrical equipment, and it is seen from Table 2 that the "Aroclors" are at least as good in this respect as mineral oil. Without taking a prohibitively large number of readings, it was not possible to obtain a curve of breakdown strength against temperature. Coupled with the similarity in s.i.c. between the paper and the dielectric which leads to a greater uniformity of stress across the system, this high breakdown strength leads to good high voltage performance with "Aroclor" capacitors.

S.I.C. and Power Factor Measurement

To obtain power factor and s.i.c., the null point on the Schering bridge was detected by an a.c. amplifier with its output rectified to feed a d.c. milliammeter. A total immersion coaxial cylinder type of test cell constructed in stainless steel was used.[9] A thermostatically controlled oil bath was used for the upper temperature ranges and a refrigerator below room temperature. The latter was controlled by a thermostat and pump passing into a cooling bath acetone cooled with solid carbon dioxide.

In dielectric measurements, the cleanliness of the test cell is of great importance. This is especially the case with the "Aroclors," since their high s.i.c.'s tend to

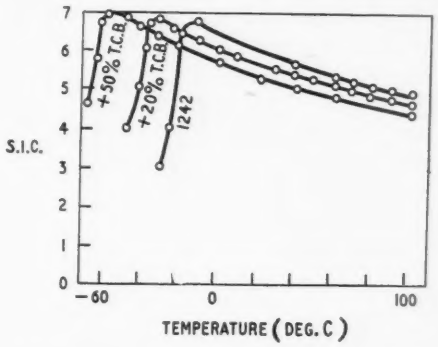


Fig. 11.—The effect on s.i.c. of adding trichlorobenzene to "Aroclor" 1242, measurements being taken at 1,000 c/s

TABLE 2.—BREAKDOWN VOLTAGES OF "AROCLORS" AND MINERAL OIL

1242		1248		1254		1260		Mineral Oil	
Temperature deg C	Breakdown Voltage kV	Temperature deg C	Breakdown Voltage kV	Temperature deg C	Breakdown Voltage kV	Temperature deg C	Breakdown Voltage kV	Temperature deg C	Breakdown Voltage kV
21	51	13	60	30	>64	13	>87	20	68
42·5	60	25	58	40	73	47	>87	42	53
65	60	50	64	75	72	52	>64	58	45
87	68	59	67	100	>71	77	64	78	62
103	66	80	64			103	60	103	62
		100	61						

produce higher ionization of impurities than occurs with mineral oil. These impurities give rise to errors in power factor, volume resistivity and electrical breakdown strength measurements. The cleaning agents normally used with mineral oil should not be employed here. Benzene is the correct solvent and the cell and all other equipment in contact with the " Aroclor " to be tested should be boiled in this solvent. If the cell has many crevices it is advisable to repeat this process. Next, all parts should be thoroughly scoured with a paste of trisodium phosphate and then immersed in several successive washings of boiling distilled water. Finally, the cell should be dried for two hours in an air oven at 100 deg. This procedure was adopted for these measurements.

It was found with the type of bridge used that 50 c/s mains interference made measurements at this frequency difficult, since " pick-up " masked the signals. Therefore the oscillator was adjusted to yield a 60 c/s voltage. It was found that the 50 c/s interference and the 60 c/s applied voltage produced a 10 c/s beat frequency which disappeared at balance, thus facilitating the setting of the bridge.

At lower temperatures, errors were produced by frosting of the surface of the fluid, since the terminals of the two electrodes were thus connected by a conducting path of water as they emerged through the surface. This was avoided by using a very deep vessel for the " Aroclor " in which the test cell was immersed. The vessel was sealed from the air at the top and the leads to the cell passed through the seal. Inside the vessel, above the fluid, was suspended a tray of drying agent. This ensured a completely dry atmosphere in the vessel so that no frosting could occur on the surface. Since the vessel was deep, it was possible to ensure that its sealing at the top was far out of the refrigerant bath and at a temperature above the dew point. This was found to give entirely satisfactory results.

Breakdown Strength Measurement

The British Standard twin 0·5in sphere electrode arrangement[3] was used with a 3 mm. gap between the electrodes. The cell was a flask with two glass sockets let into the shoulders. Into these sockets two Invar plugs were fitted and through these plugs ran stainless steel rods curved inwards at the bottom and terminating in the steel test electrode spheres. The spacing of the spheres was adjustable, being correctly obtained to an accuracy of 0·001in with a gauge. The cell was cleaned and rinsed with " Aroclor " before filling with the test sample. The assembly was immersed in an oil bath controlled by a thermostat[10] and the electrodes were connected across a high voltage test set. Breakdown voltage was measured by raising the voltage in 3 kV steps and applying the voltage at stationary values for one minute periods.

It has been shown that the " Aroclors " have those electrical characteristics that are essential for a good capacitor impregnant. With such capacitors longer lives, higher operating temperatures and higher ratings have been achieved, and to-day almost the entire output of power capacitors in America employs this type of impregnant.

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Promoting Industrial Safety

IN his annual report for 1953 (H.M. Stationery Office, price 6s 6d) the Chief Inspector of Factories (Sir George Barnett) refers to the many fields in which industrial developments have been taking place, including electricity supply and use, and radiological applications. The development of electronic apparatus for industrial purposes has greatly increased in the last few years, accompanied by a spectacular improvement in quality and output. In 1953, for the first time since the end of the war, the commissioning of new electricity generating plant exceeded the rate of growth of load. The maximum potential demand during the peak winter period, however, exceeded the supply available by over 1,500 MW, but load shedding to any appreciable extent was avoided and there was no report of any accident arising from this cause.

Although for the first time since the war years there was an appreciable increase in the number of accidents, the total was lower than the 1951 figure. Between 1949 and 1950 there was a small increase of 77, but the total in 1953 was 181,637 as against 177,510 in 1952, an increase of 4,127 (2·33 per cent). The number of fatal accidents decreased from 796 in 1952 to 744 in 1953.

The accident rate per thousand workers in factories during the year 1953 was 22·7 as compared with 22·5 for 1952, showing that accidents increased more than proportionately to the working population. The general picture, except in the metal trades in which there was a 7 per cent reduction in accidents, was of increased personnel and a somewhat more than proportional increase in accidents, due mainly to the increased number of man hours worked.

The number of electrical accidents reportable under the Factories Act was 744, of which 40 were fatal. This represented an increase of 23, including two fatal accidents, over the previous year. In addition to the 40 fatal accidents reportable, a further 86 electrical fatalities in places outside the scope of the Acts came to the notice of the Department.

A detailed analysis of the electrical accidents shows that there are certain common causes which tend to regulate the statistical outcome within limits which are sufficiently close to enable some useful conclusions to be drawn. Excluding 162 cases of welding eye-flash, three points become apparent. First, the largest group is that of unskilled male workers, accounting for 231 accidents, that is, 40 per cent of the total of 582. The next largest group comprises electricians, jointers and mates, and accounts for 179 accidents, that is, 31 per cent of the total. Finally, the categories shown as skilled and unskilled account for totals of 304 and 278, a nearly equal division, representing 52·2 per cent and 47·8 per cent respectively.

In recording the nature of the injuries received perhaps the most instructive figure is the number of cases of accident involving electric shock. During 1953 this figure was 300. Some were accompanied by burns, while others were not. The number of electrical accidents involving burns, with or without shock, was 347 and the number of accidents involving shock and burns together was 104.

ELECTRICAL PROGRESS—1954

Activities of Bruce Peebles & Co., Ltd.

AN overall survey of the activities of Bruce Peebles & Co., Ltd., during 1954 shows that, on the whole, manufacturing conditions were comparable to those of the previous year. Again, the principal activities were centred in heavy generating plant, power transformers and rectifiers for railway electrification, supplemented by motors for industrial electrification, and flameproof motors for oil refineries and coal mines.

Large output generators manufactured formed a significant proportion of the total capacity of heavy rotating machines being supplied for many destinations. A few of the more important large machines completed or commissioned during the year were 16,380 kVA and 10,000 kVA synchronous condensers, and 14,000 kVA and 11,000 kVA generators for export. Large capacity plant in various stages of design or manufacture include numbers of generators and synchronous condensers up to 24,700 kVA for various hydro-electric schemes at home and abroad.

Among new orders received for large machines are contracts for generating plant up to 14,120 kVA complete with turbines for hydro-electric schemes in Great Britain. An order has also been received for a 2,200 kW gas turbine driven generator for a peat burning power station (the first in the world for public supply) at Altnabreac, Scotland.

Progress has continued in the design and manufacture of large induction generators and this type of machine has advanced into a position of much broader acceptance in public supply as well as for industrial power systems than it has occupied in the past. Several in sizes up to 2,400 kW were completed during the year and the continuing growth in the use and size of these machines, which operate in parallel with synchronous generators, is reflected in the orders received during the year for 4,000 kW low speed vertical induction generators complete with Kaplan water turbines for hydro-electric schemes in Scotland. When completed these machines will be amongst the largest of their kind in Great Britain.

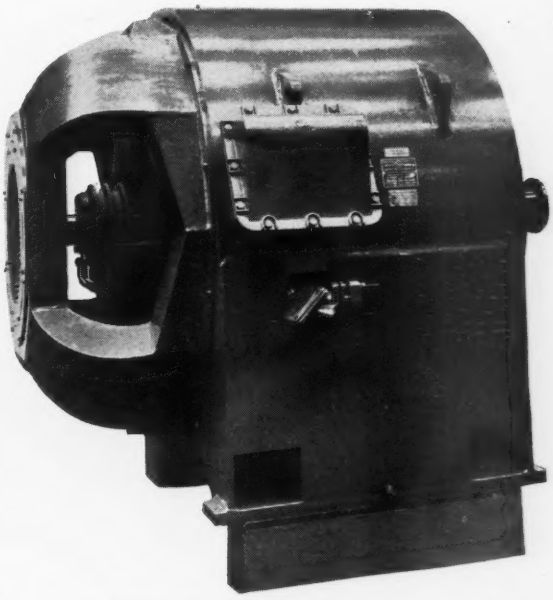
Numbers of other types of generators—geared steam turbine and engine type—of moderate size have been completed or are in hand for installations at home and overseas; and converting plant is on order for Turkey and Portugal. A 1,500 kW frequency booster for supplying a 1,150 ton walking dragline for use in open cast mining has been installed and an additional unit is in course of manufacture.

In the field of industrial electrification large a.c. motors of the induction and synchronous induction types have been supplied or have been ordered, some being for export. A large motor for use in a wind tunnel was successfully tested and put into commission at an aircraft establishment. Both "standard" lines of motors and "specials" covering a wide range of sizes up to 2,100 b.h.p., for general industrial purposes including numbers of squirrel cage motors in sizes of over 2,000 b.h.p. for direct-on-line starting featured in the company's activities.

The oil industry has shown considerable interest in the company's newly designed large output flameproof motors and orders have been received for Buxton certified motors of over 600 b.h.p. for oil refinery duty in the Middle East. The modernization of coal mining equipment continues and has brought new orders for flameproof and other types of motors for mines all over the country.

Important deliveries made by the transformer department include units from a few kVA for rural distribution schemes up to 45 MVA for voltages up to 132 kV for home and overseas. Many 1,500 kVA air-cooled transformers were completed for a Government establishment and mining type transformers figured in the operations of the company. Large capacity transformers in various stages of design or manufacture include units up to 120 MVA for the 275 kV super-grid, to which new orders for large units for major power schemes were added during the year. A new range of small high-rated low loss, pole mounting rural transformers has been developed with a guaranteed impulse level of 100 kV.

In the rectifier department the contract has been completed for the manufacture, supply and erection of 19 2,500 kV 1,500 V d.c. steel tank rectifier substation equipments for the Manchester-Sheffield-Wath railway electrification.



Newly developed 600 b.h.p. flameproof a.c. motor for oil refinery duties

Cooling Gas-Turbine Blades

A THEORETICAL analysis of turbulent natural convection heat transfer, applicable to liquid metals and some other fluids possessing more conventional properties, has been presented by Mr. F. J. Bayley (Durham University) to the Institution of Mechanical Engineers. The work was part of a research programme concerned with methods of cooling gas-turbine rotor blades by the evaporation of liquids enclosed within them. Most tests so far had used water as coolant, but its low critical temperature was its chief disadvantage. Far more satisfactory were certain liquid metals, especially mercury. These metals had a high thermal conductivity, making molecular heat transfer a significant factor, even in regions of intense fluid turbulence, and causing them to have characteristics different from most under otherwise similar conditions of flow.

The Trade Paper

Diffusion of Information and Experience

By A. J. GIBBS SMITH

THERE is to be found in many industries at the present time a certain lack of broad outlook and a somewhat too restricted experience on the part of the ordinary rank and file—a weakness which is undoubtedly due to their neglect of the trade paper. This does not apply to the directorate or higher ranks. For them, the study of their trade paper is a matter of regular routine. The leaders of an industry appreciate to the full the value of the trade Press as a means for keeping up-to-date, and in their frank moments would be disposed to admit that no small part of their success or advancement could be traced to it.

This attitude, however, is by no means general, and the vast majority of the workers in any trade subscribe to no technical periodical whatever dealing with their branch, although probably many of them find it necessary to take at least a couple of newspapers per day for keeping in touch with general current events. Taking a number of establishments which the writer has known intimately: in the very small one-man or retail business any trade paper entering the establishment would not be permitted out of the hands of the proprietor; in an establishment of some three hundred workers one may find that two or possibly three such periodicals are taken regularly by the firm to serve the general needs of the whole establishment, while among workers and staff there are possibly a couple of individual subscribers.

In a works of about twice the size, half a dozen technical papers are taken each week, and these are supposed to be adequate for keeping some six hundred people in touch with current technical progress; private subscribers in this case account for about another five copies. The official copies, it should be remembered, circulate to only half a dozen of the principal members of the staff, so that the position is somewhat disquieting if any importance is to be attached to an up-to-date outlook on the part of workers in general, in spite of the services rendered by public libraries to fill the gap in the case of some of the more important industries.

Contact with Co-Workers

In the case of practically all the employees of the average works, including most of the foremen, rate-fixers, estimators, draughtsmen and mechanics working a regular full-time week throughout the year, the pages of the trade paper offer them their only point of contact with the larger outside world of co-workers and competitors in the trade. That this lack of contact with the outer world of progress and invention is serious is clearly indicated in that when any important position has to be filled it is frequently an outsider who is selected, in order to bring into the establishment the invigorating effect of new ideas and that broad knowledge of the industry which the regular workers frequently lack.

That any technical journal purchased by a firm should be circulated amongst the staff is generally recognized in theory. This circulation is supposed to be effected by attaching to the front cover a list of names (which rarely exceeds half a dozen). The writer's experience of the system has never been happy, as in most cases the whole of the papers are allowed to accumulate on one desk for a period of three or four weeks, and the next person on the list is liable to be swamped at inconvenient moments by a parcel of a couple of dozen technical papers, with which it is impossible to cope unless he is in the fortunate position of being able to drop his regular duties entirely for a couple of days in order to plough steadily through this sudden influx of literature.

The truth of the matter is that the average office or workshop is not a convenient place, nor have the occupants the necessary leisure for the serious study of a trade paper. In such cases there is apt to be a feeling even on the part of the reader that he should be doing something else, a feeling which would be most assuredly shared by his immediate chief on finding that a particular job had not been completed when expected owing to some worker or other having been engaged on a perusal of a trade paper. Obviously therefore the most convenient time for any such serious reading is at home.

Every ambitious worker should subscribe regularly to his trade paper, and it may be a good plan to have this addressed to the place of employment, as there is no disadvantage in being generally known as one who is sufficiently keen on his business to keep in touch in this way with outside progress at his own expense.

Value of Individual Copy

The writer has always found the week-end to be the best time for devoting really serious attention to its contents, and it is an advantage therefore that most papers are published towards the end of the week. Items which require subsequent attention should be marked as soon as noticed. Rightly or wrongly, the writer has never made a practice of saving copies, but on the other hand he has always been careful to cut out for future reference any article which contains information of special interest.

This, of course, is a procedure which cannot be followed in the case of a copy belonging to an employer and circulated merely for information, nor can it be done with a publication which has to be hurriedly consulted in a library. When a copy has been completely read, it should be marked or initialled in some way, and if any article or pages have been cut out, it is advisable to cut off the bottom right-hand corner of the cover as an indication that the copy is incomplete.

Not only should the conscientious worker subscribe regularly to the trade paper of his industry, but he should also make full use of inquiry columns for the purpose of clearing up current difficulties and of the advertising pages for keeping in touch with interesting developments.

There is usually no danger of a private request for a catalogue being mistaken for a trade inquiry, but it is always better in such cases to state definitely the purpose for which the literature is required and, in addition, it is sometimes an advantage to state that the inquirer has no connection with a competitor.

Practice in regard to personal inquiries of this description differs from advertiser to advertiser, but far-sighted manufacturers usually have no objection whatever to

making known their productions and achievements as widely as possible throughout all ranks of the trade, as they recognize that the energetic and ambitious mechanic of to-day is the foreman of to-morrow, and probably the works manager of the day after. A draughtsman also, even if engaged only upon routine work, has frequent opportunities of specifying equipment, data upon which have been acquired in this way in the first instance.

With the service of trade news, developments and progress thus regularly and unobtrusively brought to his notice week by week, the average worker's outlook cannot fail to be broadened and his technical and commercial knowledge of the trade immensely increased. In place of being compelled to be the occasional recipient of partially digested or incomplete news of new processes from better informed colleagues, he will himself be one of the earliest to be fully and accurately posted upon all changes and developments in his industry.

Cooling Towers

IN a paper presented before the Supply Section of the Institution of Electrical Engineers on 5th January, Messrs. G. F. Kennedy and P. H. Margen (Kennedy & Donkin) discussed the economic selection of cooling towers for generating stations.

The economic duty point they arrived at by securing parity between, first, the additional annual investment to give a specific improvement in performance (e.g. a reduction in inlet and outlet water temperatures by 1 deg F at specified atmospheric and heat-load conditions) and, secondly, the value of the additional electricity generated for the same heat intake less any increase in the cost of primary plant. The second consideration, they said, involved three primary variables: station seasonal loading programme; ratio of full-load heat rejection to net area of turbine exhaust; and condenser steam temperature, which depended largely on atmospheric conditions.

By numerous charts, constructed in terms of annual station load factor and turbine-exhaust heat loading, the authors showed that smaller towers and higher water-temperature ranges could effect net capitalized savings of £200,000 for a 240 MW station. Larger turbines and their associated higher values of exhaust heat loading would make higher water temperatures economic. Part of the improvement was due to the development by the B.E.A. of "eliminators," which reduced carry-over of water drops to negligible amounts.

The dividing line between the spheres of application of mechanical- and natural-draught towers depended largely upon climate. With mean wet-bulb temperatures of 40 deg F the former were not economic, but became so above 70 deg F, which explained their predominance in America, where average air temperatures were 10 deg higher than in Great Britain.

With natural draught it did not pay to shut down some of the towers on light load, but the number of pumps in operation should be reduced. With mechanical draught some of the tower cells could with advantage be cut out on light loads or at low atmospheric temperatures so as to reduce power consumption by the fans.

River cooling was almost always preferable because of the much lower cost of river works compared with towers, better vacuum and lower pumping costs, which together might result in a capitalized saving of £800,000 for a 240 MW station. Few English rivers, however, could deal with the entire heat rejection of modern stations during dry periods, which often necessitated using both methods.

Two cooling circuits were described. In one the towers were shunted and brought into operation only when requisite to prevent undue rise of river water temperature; in the other a simple series arrangement was more suitable for smaller rivers which made only a minor contribution to cooling and did not warrant the provision of two stages of pumps. For the shunt circuit, separate condenser and tower pumps, possibly of variable speed, minimized pumping costs; where tower cooling was needed mainly in the summer, mechanical draught would generally be economic. In an instance cited where the river could absorb only 16 per cent of full-load heat rejection in the driest period, such a scheme was estimated to save a capitalized amount of £550,000 for a 240 MW station. The series circuit would require a pumping power not much less than for a pure cooling-tower station, but there remained the reduction in capital cost of the smaller towers and improvement in average vacuum.

Mr. Margen was the author of a second paper which indicated improvements possible in heat transfer at the expense of increased friction. The relation between these was shown to depend on a progressive change in the alignment of corrugated sheets which produced narrowing constrictions in the air path. From a chart included in the paper, the optimum friction factor, economic packing surface per unit ground area and corresponding cooling tower performance could be read off for any given air-flow resistance of the tower shell, the comparative cost of extending the ground area and the packing surface. The optimum friction factor could range from 0.1 to 0.5, being lowest for mechanical-draught and highest for large natural-draught towers.

Metallic Friction

THE forty-first Thomas Hawksley Lecture was delivered at the Institution of Mechanical Engineers by Dr. F. P. Bowden (Cambridge University) who took as his subject "Recent Studies in Metallic Friction." The two relevant laws, he stated, were originally enunciated by Leonardo da Vinci (1452 to 1519); the first was that friction was independent of the size of surfaces in contact and the second that it was proportional to the load. The lecturer showed friction between sliding solids to be due to localized adhesion at the small regions of contact on account of surface contamination by oxygen or other gases. In a vacuum friction became enormous. The coefficient of friction for most solids lay between 0·3 and 1·0. But for this contamination machinery generally would not move. On the other hand, at much lower friction (e.g. icy roads) ordinary conduct of life would be impossible.

In engineering the power loss in overcoming friction (20 per cent in motor cars, 9 per cent in aeroplane piston engines and 1½ to 2 per cent in turbo-jet engines) was of less importance than wear or seizure of some vital part, which limited design and shortened the effective working life of a machine. At present it was difficult to run bearings at above 300 deg C, but 1,000 deg C and very high speeds were required. This would entail the development of new and unconventional surfaces and lubricants and the problem, particularly with the advent of atomic power, was an urgent one.

Emergency Turbine Repairs

A Successful Reblading Scheme

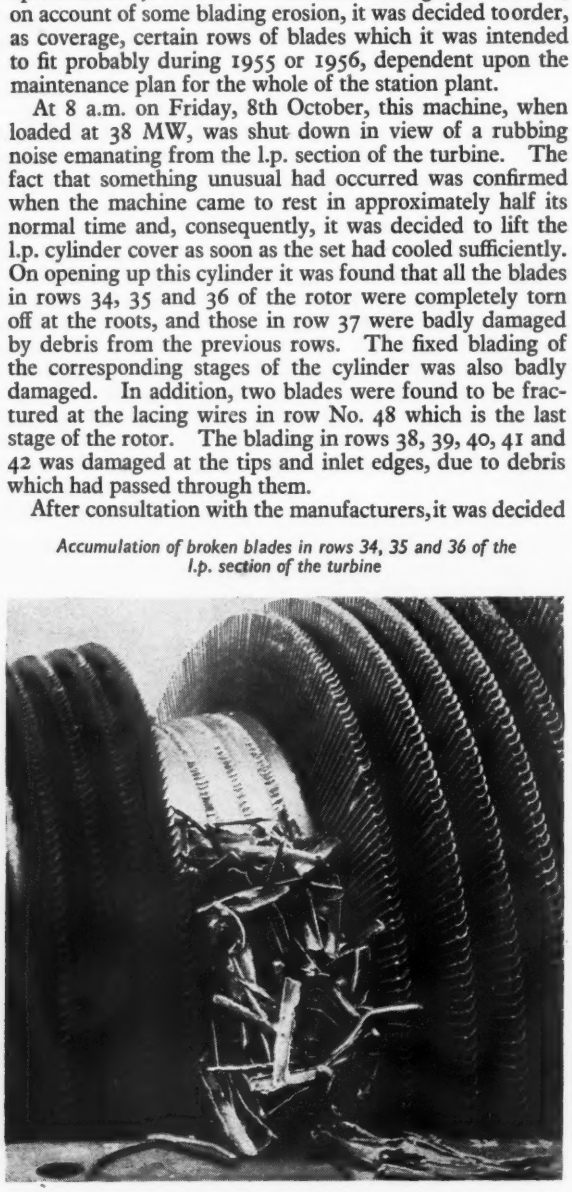
THE following is an account of a very speedy repair job which was recently carried out on No. 6 turbo-alternator at the Hams Hall " A " power station, Birmingham, of the British Electricity Authority, Midlands Division.

This machine, which was installed in 1937, has a twin-cylinder turbine of 51·5 MW capacity, operating at 350 lb/sq in, and 730 deg F. Since commissioning it has operated for approximately 93,000 hours and has not required any major blading repairs or reconditioning. The last planned examination of the machine was made in July, 1952, and from that time up to 8th October, 1954, it had operated for 6,618 hours. At the last thorough examination, on account of some blading erosion, it was decided to order, as coverage, certain rows of blades which it was intended to fit probably during 1955 or 1956, dependent upon the maintenance plan for the whole of the station plant.

At 8 a.m. on Friday, 8th October, this machine, when loaded at 38 MW, was shut down in view of a rubbing noise emanating from the l.p. section of the turbine. The fact that something unusual had occurred was confirmed when the machine came to rest in approximately half its normal time and, consequently, it was decided to lift the l.p. cylinder cover as soon as the set had cooled sufficiently. On opening up this cylinder it was found that all the blades in rows 34, 35 and 36 of the rotor were completely torn off at the roots, and those in row 37 were badly damaged by debris from the previous rows. The fixed blading of the corresponding stages of the cylinder was also badly damaged. In addition, two blades were found to be fractured at the lacing wires in row No. 48 which is the last stage of the rotor. The blading in rows 38, 39, 40, 41 and 42 was damaged at the tips and inlet edges, due to debris which had passed through them.

After consultation with the manufacturers, it was decided that rows 34, 35, 36 and 37 of both the rotor and cylinder, as well as row 48 of the rotor, should be rebladed and, in view of the fact that the machine was urgently required back in service to meet the approaching increased load period, and also that the appropriate blading was available in stock, it was decided to organize the repair work for execution on site on a 24-hour day, seven-day week basis, thus avoiding delay in dispatch to and re-delivery from the manufacturers' works and possible delay in the rearrangement of the works programme. Another factor in arriving at this decision was that, with this type of machine, the reblading problem does not involve the removal from the spindle of any wheels or discs, but is confined to the removal of old blading, blade roots and steel packers, and the refitting of new blades. A planned schedule, therefore, was drawn up and a period of 21 days fixed for completion.

Accumulation of broken blades in rows 34, 35 and 36 of the l.p. section of the turbine



Blade Assembly

The turbine is of the reaction type, the blades being fitted into grooves in the drum of the spindle. The blade roots are approximately $\frac{7}{8}$in wide, about $1\frac{3}{8}$in deep and grooved circumferentially with 1/32in deep serrations at 1/32in pitch, these serrations matching with similar serrations in the drum slots, the blades being secured by $\frac{1}{4}$in wide steel caulking strips similarly grooved, driven into the slot with the packets of blades. The number of blades per row in the area affected averages 290 ; the blade length is approximately 9in and the blades are supplied in packets or segments of a 10-blade assembly, fitted with two rows of lacing wires. In the last stage of the rotor, that is row 48, the blades are 23in long, $2\frac{1}{4}$in wide and are fitted individually, no caulking strips being employed. Special key stops are used to complete the assembly of the 200 blades which make up this row. Similar serrations are employed on the blade root and in the slot, as previously described.

The removal of the damaged blading from the fixed stages was commenced on 12th October by the station maintenance staff. The procedure for clearing the damaged blading from the cylinder top and bottom halves was to drift out the serrated packing pieces, in this case copper, which fix the segments of blades within the stage grooves.

The removal of the damaged stages from the rotor, however, presented some difficulty, and it was decided to reset the rotor in its bearings after the damaged sections had been removed from the bottom half casing, and to machine a slot out of the roots of each stage penetrating to just above the base of the root. This was achieved by first making a mild steel base-plate 24in by 18in by $1\frac{1}{8}$in thick for securing to the horizontal flange of the bottom half casing by four $1\frac{1}{4}$in holding down bolts and then welding to this base-plate a fabricated mild steel lathe slide rest support inclined to suit the radial centre line of the turbine spindle. The turbine rotor was rotated for machining by means of the barring gear of the turbo-alternator. It was necessary to rig suitable guard plates for the safety of the operator. On completion of the machining, it was relatively simple to collapse the walls of the blade roots inwards, thereby enabling them to be removed from the rotor grooves. Before machining, some of the damaged blades were burnt off at the roots; then a round nosed tool

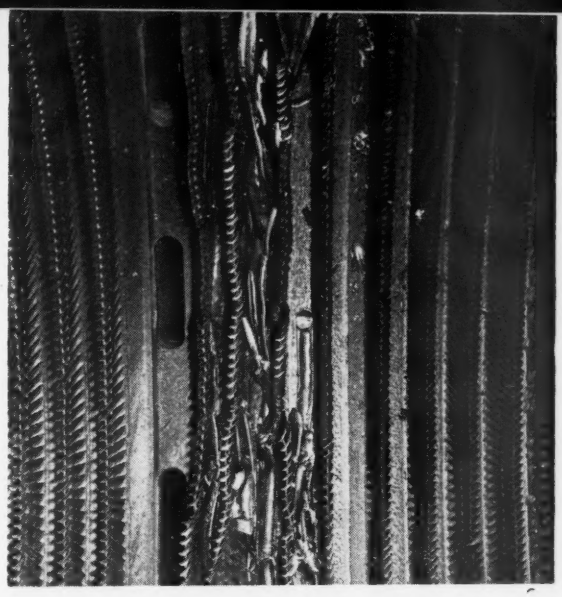
was used to remove rough ends nearly flush to give a good start for the parting tool.

An emergency stop button was provided near the operator for shutting down the barring gear and stopping the spindle in emergency. The speed of the rotor, when running on the barring gear, was 14 r.p.m. and the diameter of the spindle at the damaged blade position was approximately 4ft 3in but, despite the high cutting speed, a tungsten carbide tipped parting tool proved suitable for the work. The rotor, of course, had been previously checked over for any distortion due to this blade failure and, fortunately, was proved to be running true in its bearings.

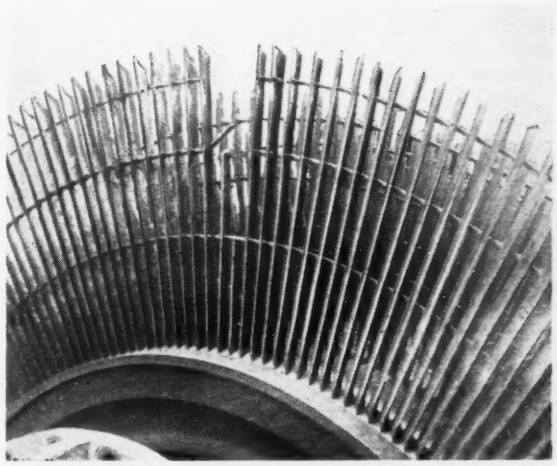
On 13th October three bladers arrived from the manufacturers and, in accordance with the continuous programme planned, one blader and two station mechanics worked at night, and two bladers and three station mechanics during the daytime. Thus by the early morning of 18th October the work of removing the scrapped blading from rows 34, 35, 36 and 37, and also the blades from row 48 of the rotor was completed. Reblading of the rotor was begun immediately, using the blades already in the station stock as previously mentioned, and the labour was reinforced by the arrival of two more experienced bladers from the manufacturers' works. Concurrently, the work of removing the damaged blades from rows 34, 35, 36 and 37 of the top and bottom halves of the cylinder had proceeded and this was also completed at the same time as the rotor. Refitting the new stationary blading in the cylinder top and bottom halves was commenced immediately.

By mid-morning on 25th October all reblading work was completed, with the exception of brazing the lacing wires, which meant that nine rows of blading were renewed in a period of seven days. The brazing was finished on the morning of 27th October, when the spindle was reset within the cylinder for checking blade clearances and making the necessary adjustments. Concurrently with the progress of the work of reblading, the Divisional Testing Department carried out a magnetic crack detection test on every blade in the remaining stages of the rotor, which amounted to some 10,000 individual blade tests. This proved that there were no cracks in any of these blades.

The work of trimming up the damaged inlet edges of rows Nos. 38 to 42 inclusive, of the rotor, was undertaken

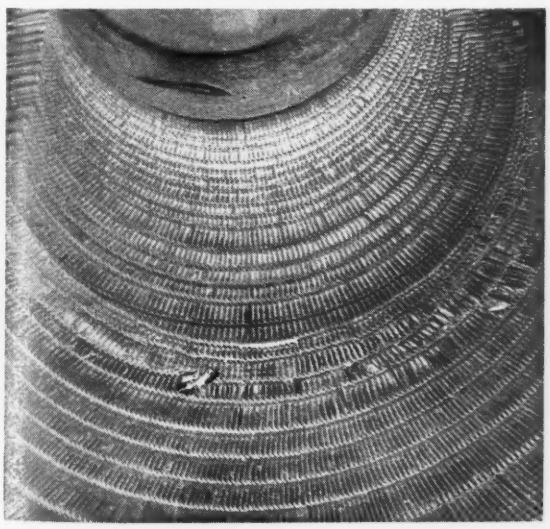


Looking down into the bottom half casing

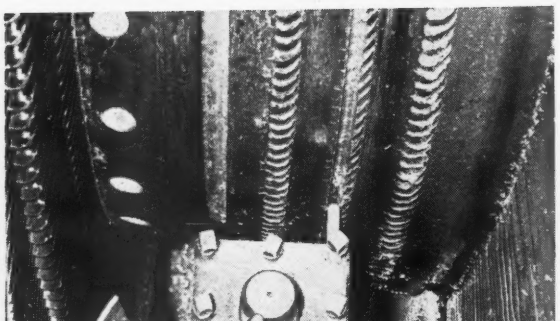


Two broken blades in row 48

The bottom half casing from the l.p. end



Damaged rows of blading being removed in the top half casing



A comparison between an old blade root after removal by machining and a new blade assembly

Left : Machining out of the broken blade roots in the turbine rotor

as the opportunity arose, a small portable grinding wheel being utilized for this purpose.

All work was completed by 1 p.m. on 29th October, the h.p. and l.p. turbines being coupled together, while the electrical rotor remained uncoupled. The total time taken from the actual breakdown to the completion of the repair amounted to 21 days and 3 hours, the man-hours employed being 1,019 by the manufacturers and 2,464 by the B.E.A.

On the same afternoon the machine was run up to speed for determining the balance of the rotor, and there was a slight amount of vibration present. The opportunity was taken to try out a new electronic balancing equipment which had recently been brought to the notice of the Division and, utilizing this equipment the following morning an improvement in the running of the l.p. rotor was effected by fixing two $8\frac{1}{2}$ oz weights to the thrust balance piston. The necessary reference generator associated with this equipment was coupled to the governor end shaft the night before the balancing took place, and was removed again while the electrical rotor was being coupled to the l.p. turbine section.

On Sunday afternoon, 31st October, the machine was placed in commission after the alternator stator had been dried out on short circuit. The total " outage " time from off load to on load, including alternator dry-out, was 23 days 9 hours.

The success in carrying out a task of this magnitude in such a short space of time lay in the planning and organization of every stage of the work, with particular attention to detail, as well as in the ready co-operation received from the manufacturers who were most helpful at every stage of the work. The principal factor of this success, of course, was that the necessary blades were all available from station stock.

Whereas in a failure of this type it is difficult to determine the cause, it is thought that, in this instance, a blade broke away from its root, probably in row No. 34 of the rotor. This conclusion has been reached as the initial examination revealed a blade to be broken off at its root in row No. 37, although it was still being held in position by the lacing wire, the fractured surface being indicative of the failure having occurred some time previously. In addition, the fractured surfaces of three blades recovered from the debris showed similar characteristics.

South African News

THE impulse generator with which the South African Bureau of Standards is being equipped will eliminate a severe drawback so far as the South African insulator and transformer manufacturing industries are concerned. The new testing plant consists of a generator from Holland with a voltage output of up to 1,400 kV to test insulators and transformers and a current output of up to 20,000 A to test surge divertors. The stored energy capacity is 16 kW seconds. The recording device consists of a two-tube high-speed cathode ray oscillograph with two precision cameras. The main sphere gap for voltage measurements is being built in South Africa. It will be possible to test transformers up to 1,000 kVA.

Meter Code

The rapid development of the use of electricity in South Africa has now reached a stage which warrants stricter attention being given to meters. The South African Standards Council was requested to draw up a code for electricity meters and a committee for such meters was appointed for that purpose. The code was eventually published for adoption on a voluntary basis. In South Africa electricity used in industry considerably exceeds the amount used for domestic purposes.

Its applications also cover a very wide field. For this reason h.v. transmission and distribution systems are necessary to supply the large demand for power at works and factories. This necessitates a type of meter designed for industrial loads and suitable for operating on h.v. systems or on low voltage. For economic and practical reasons it may be necessary to meter a factory supply on the h.v. side of the power transformer. On the other hand, it may in some instances be more convenient to meter on the low voltage side. While some of the larger electricity undertakings maintain testing laboratories, and, as far as they are able, carry out routine maintenance, this work has been neglected over the greater part of South Africa. The adoption of a code of practice and specifications for electricity meters will result in revenue saving and other advantages.

Engineering in Europe

Abstracts from Foreign Technical Journals

MEASUREMENTS for determining the power fluctuations in a tie line interconnecting two systems were carried out by an artificial separation of the French grid system into northern and southern sectors connected only by this single tie line. The investigation and interpretation of the results was based on certain theoretical definitions of the regulating energy of a system and of the "elementary correlation factor" and prepared by preliminary tests of these assumptions on a smaller scale.

In the main tests it was possible to determine the regulating energy of the system for different periods during the day. For a total power of 6,500 MW it is on an average 1,000 MW per c/s; the typical deviation of the frequency fluctuation has a constant value, viz. 0·015 c/s. The typical frequency deviation is actually related to the typical power deviation by the elementary correlation factor according to its theoretical definition.

It was also found that the rapid fluctuations of the power in a tie line affect the transmitting capacity of the latter very slightly, that an increase of the regulating power of the systems, even though it diminishes the amplitude of the frequency fluctuations in separate operation of the system, does not reduce the power fluctuations in interconnected operation; lastly, that only the slow power fluctuations really affect the transmitting capacity of the tie line.

The interconnection of two systems by a tie line whose transmitting capacity is small as against the aggregate power of the two systems is a problem of secondary regulation by which small errors of the generating programme as well as sudden and unexpected variations of the power demand may be corrected.—"Investigation and Predetermination of the Power Fluctuations in a Tie Line Interconnecting Two Power Systems," A. Chevallier, M. Holleville and P. Passerieux, *Bull. Soc. Franc. Elect.*, 7 Ser. (Vol. 4), No. 43, pp. 401–418, July 1954, in French.

New Cable Materials

Since l.v. cables up to 1 kV comprise about 80 per cent of the total length of cables used in German distribution systems these represent the economically important part of all the cable systems in the Federal Republic. An overall examination of the effects of the introduction of new sheathing and insulating materials may thus be confined to l.v. cables. The substitution of aluminium sheaths for lead sheaths has technical and economic advantages, since it obviates the danger of recrystallization failures and makes the sheath mechanically stronger, lighter and better conducting; steel armouring can be dispensed with.

The total saving in primary and erection costs is about 12–14 per cent. Existing cables boxes and joints may be used and the problem of corrosion protection was also solved satisfactorily. Large-section single-core cables are now available for a.c. operation. The replacement of the conventional paper and compound cable insulations by modern plastic materials is, though promising, by no means so simple as the replacement of the classic sheathing metal by another. Dielectric characteristics as well as other properties required of insulants are influenced by temperature, moisture and often by electrolytic or other ionic processes, and therefore the composition of satisfactory cable dielectrics is a problem on which specialists in many countries have still to work very hard, despite notable successes in developing cable types with plastic insulation and synthetic rubber sheaths for special purposes.

The author describes a number of these types of U.S.A. and German origin, gives results of tests on them and also discusses the layout of cabled interconnected distribution systems in which the distribution cables are aluminium-sheathed and the service cables plastic-insulated and sheathed ("Protodur") cables, this resulting in savings of up to 48 per cent.—"Technical and Economic Problems of the Use of Cables, with Special Reference to New Materials for the Insulation and Sheath," H. Materna, *Elektrizitätswirtschaft*, Vol. 53, No. 15/16, pp. 462–471, August, 1954, in German.

Air Circuit Breakers

A short history of the evolution of circuit breakers and the parallel development of the insight into the various phases of the breaking process prefaces the consideration of the main types of modern circuit breakers from the viewpoint of the particular effects on which they rely to accomplish their duty. Modern air circuit breakers with magnetic blowout are by no means a return to a type originally used and then relinquished, but a practical application of principles which were recognized and studied in other types of breakers. The blow-out coil displaces the arc in order to draw it out, to split and cool it, all this resulting in an increase of its resistance; the effect achieved by the latter fact being that the arc current is then almost in phase with the voltage across the break, this resulting in a considerable reduction of the restriking voltage. The dielectric strength in the gap recovers then quickly enough to withstand the restriking voltage.

An interesting analogy with the modern air circuit breaker is the modern high-duty h.v. fuse, of breaking capacities 500–1,500 MVA at 7–35 kV. In this case the fusion and evaporation of a silver wire results in a creation of a practically insulating atmosphere of silver-vapours in the break. These fuses illustrate nearly ideally the full efficacy of the principles of arc-extension and cooling in a refractory medium surrounding the fuse element. The conditions are not quite so favourable in the magnetic blowout breaker, since the arc resistance cannot be increased so quickly as in the high-duty fuse, owing to the inertia of the mechanical parts and of the blowout effect. On the other hand, the restriking voltage is relatively smaller owing to the post-arc resistance which acts like a shunt-resistance and damps the amplitude of the transient oscillations. These principles are exemplified on the "Magnetor" circuit breaker whose design and performance is described in full detail.—"Air Circuit Breakers with Magnetic Blowout for Medium-Voltage Systems," M. Perolini, *Bull. Sci. Assoc. Ingén. Montefiore*, Vol. 67, pp. 529–558, October, 1954, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Space Heating

IN my letter of 13th October I commented on Mr. W. F. Walton's space heating watts per cu ft, published in your issue of 8th October. His figures were approximately one-third of those taken at my house, where in three downstairs rooms and a vestibule of about 6,000 cu ft there is a steady annual consumption of 21,400 kWh; the published graph claimed that thermal storage heaters would provide the same standard of comfort for 30 per cent of the cost.

I give below kWh readings taken over two periods of 100 days, with average outside mid-day temperatures, the window space being 180 sq ft:—

1953–54 *5th Dec. to 15th Mar.*		1954 *7th Aug. to 15th Nov.*
5,644	Floor heating units	2,127
5,675	Oil and built-in wall heaters	1,508
11,319		3,635
40·9 deg F	Average temperature at 1 p.m. each day	58·1 deg F

I suggest that it would be well to compare these figures with other space heating users in this vital load building process.

Leicester. B. GILL.

Different Outlooks

IN the *Electrical Review* of 19th November, Mr. R. C. Golding wrote of the mixed feelings evoked in him on reading your editorial, in an earlier issue, covering the Productivity Report on Industrial Engineering. My feelings on reading his comments are not mixed but definitely outraged. Mr. Golding is one of that fortunately small band of expatriates who delight in denigrating the people of his own country. Now lest I invite criticism for writing about that which I know not, let me say that I, too, have intimate knowledge of conditions in both the supply and utilization sections of the electrical industry on both sides of the Atlantic. My experience has come by way of work performed from the Arctic Circle to the Mexican border of the American Continent, and in India, Ceylon, Malaya, Australia, Africa, and early years in Britain where my time was divided between the supply and the utilization sides of the industry. My judgment, I claim, has become quite impartial.

In Ontario I was employed by one of the better known manufacturing electrical engineering companies on the North American Continent. Neither in the Canadian plant nor in the parent organization in the United States did I find anything in basic procedures and methods startlingly different from what I had seen in Britain and elsewhere. Quantity output does of course have a large effect on *application* of methods. Progressives there are of course, as in plants in other countries, struggling against works tradition and ultra-conservatism.

If, as Mr. Golding claims, the difference between Britain and Canada is one of outlook, then surely this difference has been engendered by sets of conditions so basically different as to defy comparison. England is a country practically devoid of natural resources. (Coal as a resource is an outstanding exception, and one that has evoked considerable comment, not a little of which is nonsense because it is ill-informed. It is necessary merely to attempt to compare the physical realities of coal mining in Canada and the United States on one hand, with those of the mines in Britain to discover how difficult a true comparison becomes.) The trend, type and scope of economic and industrial expansion, the exploitation of mineral resources now proceeding in Canada, nowhere run parallel with anything that has happened or could happen in Britain.

The current rapid expansion in Canada has created unique sets of conditions, the like of which do not and could not exist in Britain. There is not the space here nor any need to attempt to encompass the whole grand sweep of events now unfolding in the length and breadth of Canada. It is sufficient to stay close to the examples of "attitude" or "outlook" instanced by Mr. Golding. First we have the new housing estates, where I claim quite definitely that skilled labour is not available for overtime at ordinary rates of pay. In any event, does Mr. Golding hold that conditions are superior where men must work underpaid overtime to make it possible for them to pay a wife's passage, make a down payment on a car, house or anything else?

Now I, too, occasionally saw temporary lighting around houses in course of construction. The men at work told me they were building for themselves, since for them it would be very difficult to become house owners otherwise. Many of them just completed the basement and the flooring above it, covering this with roofing felt, and then lived in the structure whilst completing the work above ground. It is necessary to add that bricklaying is an activity rarely witnessed on housing estates in North America. The cost of brickwork is higher than that of timber and/or asbestos walls, and so the "frame" house preponderates, almost to the exclusion of the brick type.

In Canada I resided in an apartment block, where, during my tenancy a steel fire escape was added. The men doing the work carried on through Saturday, an unusual thing in Canada, so I attempted to question them about this. Only one of five could converse with me, and he explained that all were Italian immigrants pleased to work for the 95 cents an hour they were receiving, rather than ask for assistance. Not one was a trained construction worker, and all were working at pay far below that enjoyed by skilled Canadian labour. This of course is but one instance and no claim is made for it.

Mr. Golding says the unions in Britain must change their outlook. Are they then so very different? I commend Mr. Golding to a close examination of the reports of the conciliation authority operating between employers and employed in Canada. He should also compare the number of disputes listed per annum in Canada with the numbers listed for the same periods in other countries.

The statement "there should be more and more small industries" is ludicrous on a continent where almost the ultimate has been reached in mechanization of the manufacturing and construction industries, and is being followed

rapidly by " automatization " of whole sequences of manufacturing processes. What hope is there for the small business against such competition?

Back in the twenties and thirties of this century in Britain, which were the days of surplus labour, a man had to maintain " output " or else see one of the many unemployed take his place. Compare outputs of to-day with those of twenty-five years ago. Has not output improved all round, and without the threat of unemployment as a goad? In nationalized industries has not the tendency been toward a more human relationship between employer and employed?

In the matter of pre-war *versus* post-war methods of running the electricity supply industry in Britain (in which Mr. Golding has obviously injected more than a little of personal feeling) it must always be remembered that at vesting day, those running the industry were in the great majority the very same people who were running it the day before. After vesting day they were permitted to and did employ more assistants than they were ever allowed to have before that date.

As one standing without and apart from Britain's electrical industry since pre-war days, I have seen a power generation expansion programme implemented that could not have been undertaken by the privately owned industry. More engineers have been employed under conditions that lose nothing by comparison with what was on offer in the 'thirties, and for that matter with what is still on offer by a part of private industry to-day.

The contracts awarded to the manufacturing side of the electrical industry have been so many that one can now read advertisements issued by companies (manufacturers of transformers and switchgear) which did not exist in pre-war days. So there is much more than a little to be said for the industry in its nationalized form. Let Mr. Golding cogitate on what might have been the current condition of the manufacturing side of Britain's electrical industry had it not been for the reconstruction and expansion programmes of the B.E.A. and the National Coal Board.

Mr. Golding says in his penultimate paragraph that those who go from Canada to Britain to hire labour claim that the average Briton is wedded to the " Welfare State." Mr. Golding should consult members of the German community in Canada; they, too, tell of men reluctant to leave West Germany for Canada because of the lack, in Canada, of social security such as obtains in their home country. Of what use is it they say to earn double or treble the home country rate of pay if one serious illness in the family can wipe out the savings laboriously gathered over many years? True, health insurance schemes do exist in Canada, but please examine their provisions carefully before commenting, and then ponder over the ever-growing demand in Canada and the United States for some form of Government sponsored health insurance.

Lack of " stratification in society," better described as a minimum of snobbery, does play a large part in the surge ahead of the population of North America. Incentive plays a larger part, though it must be remembered that within the ranks of North American trade unionists there is a strong urge to prevent a man working himself and his fellow unionists out of a job by too enthusiastic application at the point of production. This is especially noticeable in industries wherein repetition machine work cannot be applied; the construction industry is a case in point. This apart, men in certain industries can and do collect more pay for greater output, and so are able to buy a new car, a washing machine or whatever is desired. Can this be done in Britain? Does anyone seriously suggest that every working man in Britain could have a car, or anything else he fancies by merely doubling his efforts? The choice for him is not between little and plenty, but between little and much less. Examine the figures of productivity per man in Britain over the past twenty years; they show consistent improvement, but always remember that even a doubling of output per man (assuming a market existed for it), could be nullified by an adverse change in the price of raw materials imported.

My travels have taught me that the amount of work put into a day by men anywhere in the world varies but little on any given task; that a market capable of absorbing millions of cars per year is likely to develop a car manufacturing industry and techniques much more highly mechanized than one consuming only thousands of cars per annum; that a country still expanding and liberally supplied with natural resources, cannot easily be compared with one not so bounteously endowed.

Finally, why sneer at one's own countrymen merely because they have carried the much extolled principle of insurance to its logical conclusion? " Welfare State," in some quarters has become synonymous with " despicable." I ask all who think thus to examine the position anew, and become amazed at the great number of points whereat their own lives are eased and assisted by Government aid, which truly is an attempt to even out the burden, to exchange aid between fellow men, and not in any sense despicable. People should beware of " productivity " or any other reports based on fleeting glimpses of industries, peoples or countries.

McKinney, Texas, U.S.A. A. L. DAVISON.

Recording Electrical Signals

EQUIPMENT of instrumental accuracy for recording and reproduction (play-back) of electrical signals within a frequency range of 0 to 1 kc/s and using cinematographic film was described in a paper given by Mr. McG. Koss (formerly with Elliott Bros. (London), Ltd., and now with Ferranti, Ltd.) at a meeting of the Measurements Section of the Institution of Electrical Engineers.

Errors, he said, were about ± 1 per cent over most of the range, but increased at maximum amplitude and frequency. Reproduction could be on a faster or slower time scale. A simple film-traversing mechanism was used with variable speed drive and optical attachments. One type, giving variable-density tracks on the film, employed variable-intensity discharge lamps, the outputs of which were monitored by photo-cells to provide negative feed-back to the amplifier. A second type, giving variable-width tracks, used modified Duddell oscillographs and was based on standard cinematographic practice; it was found to give greater accuracy, constancy of calibration and reliability. Subsidiary equipment provided for recording on a film the mechanical signals and data transcribed from other recording apparatus or numerical data applied manually.

In reproduction from records the light transmitted through each track was measured by a photocell, outputs from the equipment being presented as voltages; the film provided two tracks carrying accurate independent information and a third for timing marks or a reference frequency.

Higher Eastern Area Charges

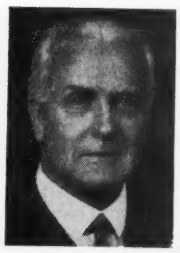
ON Tuesday the Eastern Electricity Board announced details of the revised electricity charges which are to be introduced in the Area on 1st April (see *Electrical Review*, 17th December, 1954, page 986). Domestic consumers, the largest class affected, will pay 6d more a week on the fixed charge of the two-part tariff and there will be similar increases in the combined premises and farm tariffs. In the block rate, which applies mostly to commercial consumers, the " unit " price of the middle block will be raised from 1½d to 2d and the number of kWh in each step will be made uniform. The maximum demand tariff, under which the larger industrial consumers pay for their supplies, is still under examination.

New Year Honours

Awards to Electrical Men

THE number of electrical men who have been included in the New Year Honours is somewhat smaller than usual, but several well-known names are included in the List.

SIR ARNOLD GRIDLEY, K.B.E., M.I.E.E., M.P., chairman of the Southern Areas Electric Corporation and subsidiary companies, has been created a baron, and MR. I. R. COX, D.S.O., Hon. D.Sc., managing director of the Metropolitan-Vickers Electrical Co., Ltd., has had a knighthood conferred on him.



Sir Arnold Gridley

Mr. I. R. Cox

New Commanders of the Order of the British Empire (C.B.E.), include MR. F. W. HALLIWELL, president of the Gauge & Tool Makers' Association; MR. H. E. JACKSON, late president of the British Non-Ferrous Metals Federation; MR. C. T. MELLING, M.Sc.Tech., M.I.E.E., M.I.Mech.E., M.Inst.F., F.I.I.A., chairman, Eastern Electricity Board; MR. V. A. PATTERSON, deputy chairman and managing director, J. & E. Hall, Ltd.; and MR. A. WATSON, B.Sc., M.I.Mech.E., M.I.E.E., chief mechanical and electrical engineer, Air Ministry.

Mr. C. T. Melling

Mr. A. Watson

New Officers of the Order of the British Empire (O.B.E.), are ALDERMAN J. CLARRICOATS, general secretary, Radio Society of Great Britain; MR. R. CONNOR, D.S.M., director and general manager, Measurement, Ltd.; MR. H. DUCKWORTH, superintending electrical engineer, Admiralty Engineering Laboratory; MR. P. PHILIP, M.I.E.E., M.I.Mech.E., M.Inst.F., area manager, Dundee, North of Scotland Hydro-Electric Board; MR. V. W. M. ROBERTS, B.Sc., A.M.I.E.E., commercial manager, Electronics Department, British Thomson-Houston Co., Ltd.; MR. J. SHACKLETON, engineering superintendent of design, Atomic Energy Authority; MR. G. A. VOWLES, M.I.E.E., M.I.Mech.E., divisional controller, Yorkshire Division, British Electricity Authority; and MR. A. KENNEDY, director, Electrical Department, Bahamas.

Mr. V. W. M. Roberts

Mr. G. A. Vowles

Members of the Order of the British Empire (M.B.E.), include the following:—MR. G. ANDERSON, manager, Welding & Fabricating Department, Bruce Peebles & Co., Ltd.; MR. F. H. CROCOMBE, M.M., district engineer, Minehead District, Taunton Sub-Area, South Western Electricity Board; MR. D. DUNSMORE, superintendent, Brush Electrical Engineering Co., Ltd., Loughborough; MR. D. FAIRWEATHER, chief of crystal production, Marconi's Wireless Telegraph Co., Ltd.; MR. W. FIELDING, senior telecommunications superintendent, North Eastern Region, G.P.O.; MR. W. GEARY, assistant superintendent, Metropolitan-Vickers Electrical Co., Ltd.; MR. A. E. HILL, B.Sc., manager, Glass Works, British Thomson-Houston Co., Ltd.; MR. C. C. KNOWLES, works manager, William McGeoch & Co., Ltd.; MR. C. J. LEVER, works manager, Siemens Brothers & Co., Ltd., West Hartlepool and Spennymoor; MR. C. B. P. MORTON, D.S.O., D.F.C., assistant to the chairman, Matthew Hall & Co., Ltd.; MR. W. R. PEATLING, apprentice supervisor, Telegraph Construction & Maintenance Co., Ltd.; MR. E. E. PHEASEY, works manager, Foster, Yates & Thom, Ltd.; MR. W. S. READ, manager, Fraser & Chalmers Engineering Works, Erith; MR. J. J. SARCHE, chief inspector, Ultra Electric, Ltd.; MR. H. E. WASSER, chief testing engineer, Midlands Division, British Electricity Authority; MR. A. W. WHITTAKER, senior executive engineer, London Telecommunications Region, G.P.O.; MR. H. W. HALSTEAD, engineer (radio), Posts & Telegraphs Department, Fiji.

Recipients of the British Empire Medal are:—MR. H. ADAMS, turner, Joseph Lucas, Ltd.; MR. W. W. AKED, skilled electrical fitter, J. Stone & Co. (Deptford), Ltd.; MR. J. ANDERSON, substation attendant, South East Scotland Electricity Board (Edinburgh); MR. J. BECK, leading turbine driver, Kilmarnock generating station, South West Scotland Division, British Electricity Authority; MR. F. COLLISON, chargehand jointer, North Eastern Electricity Board (Middlesbrough); MR. G. H. ENGLAND, jointer, Southern Electricity Board (Weymouth); MR. F. J. GOUGH, superintendent, power station, Moascar, War Office; MR. L. F. HITCHCOCK, electrician, South Eastern Division, British Electricity Authority (Tonbridge); MR. E. T. HODGSON, jointer, North Western Electricity Board (Keswick); MR. A. NIGHTINGALE, turner, British Insulated Callender's Cables, Ltd., Prescot; MR. J. RILEY, foreman, Assembly Department, British Timken, Ltd.; MR. W. M. ROBINSON, senior foreman, R. B. Pullin & Co., Ltd.; MR. H. SHAW, weighbridge attendant, Hartshead, North West, Merseyside & North Wales Division, British Electricity Authority (Stalybridge); MR. G. SPARKS, chief electrical inspector, William McGeoch & Co., Ltd.; and MR. F. C. WALLER, fitter (electrical), Enfield District, Eastern Electricity Board.

Welding Electrodes Directory

Section I of a "Directory of Welding and Fabricating Equipment," reprinted from *Welding and Metal Fabrication* and published by the Louis Cassier Co., Ltd., Dorset House, Stamford Street, London, S.E.1 (35 pp., price 3s 6d, by post 3s 9d), is claimed to be the first guide to the entire range of electrodes now available in the United Kingdom. It gives details of each British electrode, for welding any of the metals at present used in the fabricating industries.

The directory is divided into five parts, dealing with electrodes for arc welding mild steel, alloy steels, cast iron, non-ferrous metals, and for hard-facing. The electrodes are grouped under the name of the respective manufacturers, and the main details are given for each electrode, together with any special features. Recommended welding positions for each electrode are given, and the classification numbers are shown against the electrodes for welding mild steel and the medium- and high-tensile steels, according to B.S. 1719: 1951.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. **Thomas Johnston,** C.H., LL.D., chairman of the North of Scotland Hydro-Electric Board and **Sir Hugh Mackenzie,** C.B.E., deputy chairman of the Board, whose current terms of office expired at the end of 1954, have been re-appointed by the Secretary of State for Scotland for a further period.

The Secretary of State has also re-appointed for a further term three of the members of the Board, **Mr. W. Leonard,** J.P., Glasgow, **Treasurer G. R. McIntosh,** C.B.E., J.P., Aberdeen, and **Mr. A. I. Mackenzie,** B.A., C.A., Glasgow.

Mr. S. C. Riggott, A.M.I.E.E., A.I.Mech.E., M.Inst.F., station superintendent at Cowes generating station, has been appointed to a similar position at the Portsmouth generating station of the Southern Division of the British Electricity Authority. Mr. Riggott was educated at Derby and at Nottingham University College, and was apprenticed to the L.M.S. Railway. From 1930 to 1938 he was at Derby power station, first as chemist and then as assistant to the boiler house superintendent; subsequently he was chemist and combustion engineer at Thorpe generating station, Norwich, until 1941, when he was appointed combustion engineer at Roath, Cardiff. He became deputy station superintendent at Roath in May, 1948, and went to Cowes in 1951.

Mr. S. C. Riggott

Mr. A. W. Gostt and **Mr. W. A. Kimber,** who joined Philips Electrical, Ltd. (then Philips Lamps), together in 1929, recently completed twenty-five years' service with the company. To mark the occasion celebration luncheons were held and the presentation of cheques and inscribed watches was made by Mr. G. Hofman (managing director).

Mr. Gostt received his training at Regent Street Polytechnic and the Metropolitan-Vickers Electrical Co., Ltd., as an illuminating engineer and served with Philips in that capacity until 1934 when he became chief technical assistant in the Electrical Discharge Lamp and Lighting Department. Two years later he was appointed departmental manager. Since 1952 he has held the post of sales manager (technical) of the Lighting Division. Mr. Gostt is a Fellow of the Illuminating Engineering Society. He has served on a number of committees in connection with such bodies as the Electric Discharge Lamp Auxiliaries Council, the Electric Light Fittings Association, the International Commission of Illumination, the Electric Lamp Manufacturers' Association and the British Standards Institution.

Mr. Kimber began his career with Philips in the Accounts Department, transferring to the lighting side in 1934. He worked in the Discharge Lamp Department until 1950, when he was appointed to his present post of manager of the Tungsten Lamp Department. Mr. Kimber served as chairman of the Sales Committee of E.L.M.A. for the year 1953-54.

Under the British Transport Commission (Organization) Scheme Order, 1954, the administration of the B.T.C. system is being delegated to Area Boards which begin to function on 1st February. Appointments to the Boards, announced last week, include the following:—**Sir Philip Warter,** chairman, Enfield Cables, Ltd., etc. (chairman, Southern Area Board); **Mr. K. Preston,** chairman, J. Stone & Co. (Holdings), Ltd. (Southern Board); **Mr. A. C. Chamberlain,** director, Tube Investments, Ltd. (Western Board); and **Capt. Hugh Vivian,** director, Associated Electrical Industries, Ltd. (Western Board).

Mr. G. R. Tyler has retired from the position of manager of the Maritime Division of Marconi's Wireless Telegraph Co., Ltd., but will remain with the company as its representative in West Africa. He has been succeeded as manager of the Maritime Division by **Mr. B. G. H. Rowley,** M.A. (Oxon.), A.M.I.E.E., formerly the company's technical representative in the United States and Canada.

Mr. B. G. H. Rowley

Mr. Rowley was educated at Alleyn's School, Dulwich, and New College, Oxford. On the outbreak of the last war he was first engaged on radar development work for the Royal Navy at H.M. Signal School and then on radar duties with the Home Fleet. In 1942 he was for a short period attached to the United States Navy for radar liaison duties in the North Atlantic, and was later appointed to the staff of the British Admiralty Delegation in Washington, a post which he held until the end of the war. After the war Mr. Rowley, who then held the rank of lieutenant-commander, continued with the British Joint Services Mission in America as staff radar officer, until joining Marconi's in 1950 as United States technical representative stationed in New York.

Mr. E. B. Rogers, manager of the service department of the Valve Division of Mullard, Ltd., retired last week after twenty-eight years with the department. He is succeeded by **Mr. F. E. Debenham,** who has been deputy manager for the past three years.

Mr. J. S. Liversage has been appointed Manchester branch manager of Cryselco, Ltd., in succession to **Mr. A. H. Owen,** who recently retired after thirty-two years' service with the company. Mr. Liversage was, before this appointment, the company's Cardiff branch manager. He was elected to the Executive Council of the United Commercial Travellers' Association in 1947, was national chairman in 1951-52 and is at present chairman of the Legal Committee of that Association.

Mr. J. S. Liversage

Mr. J. B. Scott, sales director of Crompton Parkinson, Ltd., left this country on 4th January for an extensive tour of the company's overseas organization in the Far East. He will be away for between ten and twelve weeks, during which time he will visit the company's branches and agents in Burma, Ceylon, India, Malaya, Pakistan and Thailand.

Mr. G. K. Paton, M.I.E.E., of Wrexham, a part-time member of the Merseyside and North Wales Electricity Board, retired from the Board on 31st December on completion of his term of office.

Mr. Eric Dymond, A.M.I.Mech.E., A.M.I.E.E., A.F.R.Ae.S., who resigned from the board of Sangamo Weston, Ltd., some two years ago after twenty-eight years with that company, is leaving England on 15th January for a tour of indefinite duration in the United States and Canada. Mr. Dymond still retains his chairmanships

of Two Way Talkie, Ltd., and Neltic, Ltd., and has been engaged in a technical advisory capacity with various companies. His forwarding address is:—c/o Bankers' Trust Company, 455, Park Avenue at 57th Street, New York City.

Sir Hugh Warren, D.S.C., M.Sc. (Eng.), M.I.E.E., M.I.Mech.E., F.Inst.P., managing director of Associated Electrical Industries, Ltd., retired on 31st December. Sir Hugh joined the British Thomson-Houston Co., Ltd., in 1911 after taking the M.Sc. (Eng.) degree of Bristol University, and later collaborated with the late R. C. Clinker in establishing the B.T.H. Research Laboratory. He joined the board as director of research in 1938, subsequently becoming director of research and engineering and then managing director of the B.T.H. Co. Sir Hugh was appointed deputy managing director of Associated Electrical Industries, Ltd., in 1946, and he became managing director on 1st January, 1948. He was knighted in 1951.

Sir Hugh Warren

Mr. A. de M. Browne, B.Sc., A.R.C.Sc.I., managing director of the Hackbridge & Hewittic Electric Co., Ltd., has recently been appointed chairman of the company. Mr. Browne, who received his education at Blackrock College, Dublin, and the Royal College of Science, Ireland, joined the Hewittic Electric Co., Ltd., as technical development engineer in 1924, becoming chief engineer in 1930 and manager in 1936. He was appointed director in 1939, and, concurrently, sales director of the Hackbridge Electric Construction Co., Ltd., in 1941. He became a director of both companies after their amalgamation in 1947. He is also a director of the New Switchgear Construction Co., Ltd., and president of the Hackbridge & Hewittic Electric Co. of Canada, Ltd.

Mr. B. J. Randall, formerly of Cantie Switches, has joined the sales staff of the Electro Mechanical Manufacturing Co., Ltd.

On the retirement after forty-six years' service of **Mr. W. B. Leigh,** senior assistant commercial engineer in the Croydon and West Kent Sub-Area of the South Eastern Electricity Board, a presentation ceremony was held at Electric House, Croydon, at which the manager, Mr. T. A. D. Honnor, presented him on behalf of his colleagues with an electric log fire, a chiming clock and a picnic case. Mr. Leigh started with the Croydon Municipal Electricity Undertaking in 1909 and for over twenty-three years until the industry was nationalized he was chief sales assistant at Electric House, Croydon. He served on the panel of examiners for the examination of both the Electrical Development Association and the Electrical Association for Women, and on various occasions represented Croydon Undertaking on E.D.A. committees.

Mr. J. A. C. King, A.M.I.E.E., has now returned from leave in this country and his address is now c/o Department of Electricity, Government of Kuwait, Kuwait.

Mr. J. Beattie, A.M.I.E.E., has been appointed chief engineer of the new Burma pharmaceutical factory of Evans Medical Supplies, Ltd., Liverpool. A temporary production unit is planned to be in operation by the middle of this year.

The Social Club of **South Wales Switchgear, Ltd.,** visited local hospitals and neighbouring towns during the evenings of the week preceding Christmas with a Father Christmas tableau and choir. The tableau consisted of a sleigh bearing Father Christmas drawn by six life-size reindeer in a fairyland setting, illuminated by hundreds of fairy lights. The tableau and choir are shown in the accompanying picture.

The choir of the Social Club of South Wales Switchgear with the tableau which visited local hospitals and towns during the week preceding Christmas

Mr. C. L. B. White, the South Eastern Electricity Board's district commercial engineer for Thanet, has been appointed district manager, Dorking and Epsom, as from 1st January.

Mr. A. T. Smalley, O.B.E., assistant director of contracts, Post Office Contracts Department, has retired after forty-three years' service with the Post Office. He will be succeeded by Mr. P. J. Mapplebeck, F.C.A., F.S.C.C., previously the Department's principal accountant.

The management of the **Automatic Telephone & Electric Co., Ltd.,** presented monetary awards on 21st December at Liverpool to 182 student-employees in recognition of their successes in 1954 technological examinations. Mr. J. A. Mason (director and manager), in an address, said that electronics were going to play a big part in telecommunications engineering and the company was in the process of establishing a school of electronics where university graduates, and others with the necessary qualifications, would train in electronics, communication engineering, electrical measurement, materials and other subjects.

Over 200 members and their friends took part in the annual "stag party," dinner and smoking concert of the **Electrical Trades' Commercial Travellers' Association** held recently at the Windsor Castle Hotel, London, S.W.1. The chair was taken by Mr. J. H. Bowen, supported by Mr. Arthur T. Haywood, president for 1954-55. An excellent programme of variety was provided by Bert Bradshaw, the well-known entertainer.

At the annual general meeting of the **Electrical Industries Benevolent Association,** Birmingham Branch Area, held recently in Birmingham, the following officers were elected for the coming year:—President, Mr. R. L. Bailey; chairman, Mr. S. J. Vaughton; hon. treasurer, Mr. H. J. Bick; hon. secretary, Mr. F. Williams.

Simon-Carves, Ltd., Power Plant Department, announces that **Mr. J. D. Knox** has been appointed to take charge of the London office at Simon House, 6, Stratton Street, London, W.1.

Mr. N. J. Hulbert, M.P., has resigned from the boards of the British Thomson-Houston Export Co., Ltd., and the Metropolitan-Vickers Electrical Export Co., Ltd.

Three senior members of the staff of Messrs. Kennedy & Donkin have been appointed consultants to the firm. They are **Messrs. J. North,** B.A., M.Inst.C.E., **M. V. Ratcliffe,** B.Sc. (Eng.), M.I.E.E., and **F. J. Hutchinson,** M.Eng., M.I.Mech.E., M.I.E.E.

OBITUARY

Mr. W. Mills, director, former secretary and oldest employee of Brook Motors, Ltd., Huddersfield, died on 25th December at the age of sixty-six. Mr. Mills joined E. Brook, Ltd., two years after the foundation of the company and became secretary shortly afterwards, a position he relinquished last year owing to failing health. He was made a director in 1918 and remained on the board up to the time of his death. For the past four years Mr. Mills had been a director of Huddersfield Town A.F.C.

The late Mr. W. Mills

Mr. J. E. Chamberlain.—The death, on 31st December, is announced of Mr. John Eric Chamberlain, chairman and joint managing director of Switchgear & Cowans, Ltd., Manchester. Mr. Chamberlain was sixty-three years of age. He had been joint managing director of the company since it became a public company in 1936, and it was greatly due to his efforts that its activities and those of its subsidiary companies increased so rapidly during recent years. He was associated with the Hewittic Electric Co., Ltd., from 1923 to 1936, when he pioneered the use of the glass bulb mercury arc rectifier in this country.

Mrs. J. Fraser.—The death occurred on 29th December of Mrs. Agnes Hall Muir Fraser, the wife of Mr. John Fraser, press officer of the British Electrical Development Association, to whom we extend our sympathy.

B.E.A. Plant Installed Last Year

NEW generating plant installed by the British Electricity Authority during the year ended 31st December, 1954, represented an additional output load capacity of 1,431 MW or nearly two million horse-power. This compares with 1,413 MW installed in 1953.

The additional plant, comprising 29 turbo-generators with an aggregate installed capacity of 1,405 MW and 50 boilers having an aggregate evaporative capacity of 16,220,000 lb/hr, together with 17 diesel-engined generators with an installed capacity of 25·78 MW, was installed in 43 of the Authority's power stations. Six of these are new stations in which plant was installed for the first time.

The capacity of new plant installed in each of the past two years has been adversely affected during the early construction stage by the shortage of steel as the result of conditions brought about by the Korean war. Nevertheless the new plant closely approximates the level of commissioning, namely 1,450 MW, sanctioned by the Government for 1954. In all the circumstances this achievement reflects great credit on the Authority's construction staff, the plant manufacturers and building and civil engineering contractors. The steel shortage problem has now been largely overcome, and it is expected that there will be a further increase in the amount of new plant installed in 1955. Details of the plant commissioned are given in the table below.

Name of Power Station	B.E.A. Divisions	TURBO-GENERATOR PLANT		BOILER PLANT		MAIN HIGH PRESSURE PIPEWORK
		Installed capacity MW	Maker	Capacity k lb/hr	Maker	Maker
Steam Plant						
Acton Lane "B"	London	1×30	Richardson Westgarth	2×240	Mitchell	Aiton
Barking "C"	"	1×75	British Thomson-Houston	2×405	Babcock & Wilcox	"
Battersea "B"	"	—	—	1×425	" "	"
Blackburn	North West, Merseyside & N. Wales	1×40	English Electric	2×150	Simon Carves	Babcock & Wilcox
Bold "A"	"	1×30	Metropolitan-Vickers	1×300	Yarrow	Aiton
Braehead	South West Scotland	—	—	1×100	Babcock & Wilcox	Babcock & Wilcox
Brighton "B"	South Eastern	—	—	1×320	" "	C. A. Parsons
Brunswick Wharf	London	1×52	Metropolitan-Vickers	4×320	Clarke Chapman	" "
Carmarthen Bay	South Wales	1×60	" "	2×240	Babcock & Wilcox	Stewart & Lloyds
Carrington	North West, Merseyside & N. Wales	1×60	" "	1×360	" "	" "
Chadderton	" "	1×60	" "	3×360	Simon Carves	" "
Cliff Quay	Eastern	—	—	1×365	Babcock & Wilcox	Aiton
Connahs Quay	North West, Merseyside & N. Wales	1×30	C. A. Parsons	1×300	International Combustion	J. Thompson
Deptford East	London	1×52	Metropolitan-Vickers	1×250	Foster Wheeler	
Doncaster	Yorkshire	1×30	General Electric Co.	1×180	Mitchell	Aiton "
Drakelow "A"	E. Midlands/Midlands	1×60	English Electric Co.	1×515	International Combustion	"
East Yelland	S. Western	1×30	C. A. Parsons	2×180	J. Thompson	C. A. Parsons
Hackney "B"	London	1×30	" "	1×300	Simon Carves	" "
Huddersfield	Yorkshire	—	—	1×180	Bennis	" "
Ince	North West, Merseyside & N. Wales	1×60	General Electric Co.	1×550	International Combustion	Babcock & Wilcox
Keadby	Yorkshire	2×60	C. A. Parsons	2×550	Stirling Boiler Co./B. & W.	C. A. Parsons
Littlebrook "C"	South Eastern	—	—	1×360	International Combustion	" "
Nechells "B"	Midlands	—	—	2×230	" "	Stewart & Lloyds
Portobello	South East Scotland	1×60	Richardson Westgarth	1×540	" "	Aiton
Roosecote	North West, Merseyside & N. Wales	2×30	Metropolitan-Vickers	2×300	Yarrow	"
Skelton Grange "A"	Yorkshire	2×60	C. A. Parsons	1×550	International Combustion	"
Southport	North West, Merseyside & N. Wales	—	—	1×85	Yarrow	Stewart & Lloyds
Staythorpe "A"	East Midlands	—	—	1×240	Babcock & Wilcox	Babcock & Wilcox
Stourport "B"	Midlands	1×60	English Electric Co.	1×515	International Combustion	Aiton
Stella South	North Eastern	1×60	C. A. Parsons	1×550	Clarke Chapman	C. A. Parsons
Thornhill	Yorkshire	1×45	English Electric Co.	1×200	Mitchell	Stewart & Lloyds
Uskmouth "A"	South Wales	2×60	General Electric Co.	5×360	Babcock & Wilcox	Aiton
Wallasey	North West, Merseyside & N. Wales	—	—	1×85	Yarrow	Stewart & Lloyds
Walsall	Midlands	2×30	British Thomson-Houston	—	—	Aiton
Diesel Plant						
Alderley Edge	North West, Merseyside & N. Wales	1×2·0	Mirrlees, Bickerton & Day	—	—	—
Ashford "B"	South Eastern	2×2·0	" " "	—	—	—
Barugh	Yorkshire	2×2·0	" " "	—	—	—
Blackpool	North West, Merseyside & N. Wales	5×1·3	Harland Wolff	—	—	—
Buxton	" "	2×2·0	Mirrlees, Bickerton & Day	—	—	—
Clacton	Eastern	1×0·9	English Electric Co.	—	—	—
Haverfordwest	S. Wales	2×1·2	Crossley Bros.	—	—	—
Newbury	Southern	1×1·0	Ruston & Hornsby	—	—	—
Southend	Eastern	1×0·9	English Electric Co.	—	—	—

NOTE.—The power stations whose names are in *italic* type are new stations in which plant has been commissioned for the first time in 1954. The others are existing stations to which extensions have been made.

VIEWS on the NEWS

By REFLECTOR

I HAVE received from the Industry Committee on Interior Wiring Design a copy of its new "Residential Wiring Handbook." The Committee represents all sections of American electrical industry and the handbook is "endorsed" by the American Institute of Electrical Engineers, the American Society of Agricultural Engineers and the Illuminating Engineering Society. Although it may be presumed that the booklet provides counsel of perfection and that comparatively few homes will be so well equipped electrically as is suggested, it does indicate how much more advanced the Americans are than we in this country. Even allowing for the generally higher levels prevailing in the United States, it seems that there people take electricity more for granted than the British. It is possible only to give a general idea of the nature of the specifications. For the living room (typically) the necessity of adequate lighting facilities is stressed and in specifying "convenience outlets" the booklet says that they "shall be placed so that no point along the floor line in any usable wall space is more than six feet from an outlet in that space."

* * *

Assessment of the standing charge of electricity tariffs on the number of rooms in a house is a fruitful source of argument. I commonly hear of disputes over the admissibility of attics and sculleries as rooms for the purpose of the assessment but now I have come across a new one. Some houses in the Great Barr (Birmingham) area were built with one large lounge, partly divided by a partition. According to the *Birmingham Mail* some of these houses were dealt with as though the lounge were one room; in other cases it was regarded as two. The Midlands Electricity Board recently decided that this was an anomaly and has therefore got rid of it—naturally by using the two-room basis. One tenant who was affected by the change complained, rather lamely, that "after all, most of the rooms are used as one and they do have to be cleaned every day."

* * *

It is a pity that no details of the invention were given by the Rome Correspondent of the *Daily Telegraph* in a recent report. He said that an amateur inventor invited two businessmen to his Turin flat to see his new apparatus for generating an inexhaustible supply of electricity. When he started up the machine it exploded, demolishing part of the building. As a consequence the inventor and his visitors were expected to be in hospital for a month. The device would seem to be a form of perpetual motion machine; it would hardly be a breeder reactor I think. In any event the businessmen who became involved in the explosion will scarcely be anxious to bring the invention to a commercial stage.

* * *

To many of us older ones "sorrow's crown of sorrow is remembering happier things"—the days when a little money went much further than it does nowadays. We always find interest in such items as one which appears in the winter number of the *Kelvin* (the magazine of the South West Scotland Electricity Board). This is an account dated 1st August, 1902, for a new service in Scott Street, Greenock, and it reads as follows:—

> 12 yd Cable @ 7½d, 7s 6d; 2 yd Troughing @ 4½, 9d; 1 cwt Bitumen @ 7s 6d, 7s 6d; ½ lb Black Tape @ 2s 6d, 1s 3d; 5 hrs Joiner @ 9d, 3s 9d; 13 hrs Jointer @ 9d, 9s 9d; 13 hrs Mate @ 5½d, 6s 0d; 13 hrs Labourer @ 5½d, 6s 0d; 3 hrs Mason @ 9d, 2s 3d; total £2 4s 9d.

The cable (size unknown) seems to have been cheap even for those days. Another interesting point is the wide "differential" between the rates of pay of the skilled and unskilled men.

* * *

While it cannot be denied that electric power stations emit a certain amount of smoke and grit the electricity supply industry can claim with full justice that it prevents far more smoke than it makes. I would have thought that the Smoke Abatement Society would have given this fact greater recognition in its journal "Smokeless Air," but it seems to be a trifle reticent. There is one point in the latest issue of the journal which confirms this impression. In an earlier number there was an article on the heating of the Society's offices in which it was said that central heating had to be ruled out. A correspondent criticizes this decision and in a footnote to his letter reference is made by the editor to "using one or other of the various mediums—gas, oil, coal, solid smokeless fuel." It is necessary to point out that electricity, too, is often a very valuable form of office heating—and the only one which really means "smokeless air."

* * *

In the first issue of the *Electrical Review* in 1885 (3rd January) there appeared a letter from Mr. J. S. Sellon dealing with the early use of electricity for heating purposes. Mr. Sellon said:—

> "Heating by electricity has not as yet attracted the attention which so important a subject would seem to merit, and it may therefore interest your readers to know that since October, 1883, I have successfully warmed some of the smaller rooms of my house with a very simple apparatus, as described in my patent 'Electrical heating,' No. 4961, 1883 (some of the forms of which are specially designed for railway carriage warming). In heating rooms by this means there is the great additional advantage that a current of fresh air from the exterior can be passed through the electrical heater so as to enter the room at any desired temperature, within moderate limits; the outside air being, say, at freezing point can enter the room fresh and pure at a temperature of 200°, causing thorough ventilation, a matter of no small importance for sick rooms or hospitals. A modified form is used nightly in my house as a bed warmer, the heat being turned on or off at the bedside at any required moment, a great convenience for invalids. As a minor use I also employ the same principle for a chicken incubator, and it is especially applicable to the French system of 'thermostatic' nursing, avoiding the noxious fumes of gas or oil at present employed."

NEW ELECTRICAL EQUIPMENT

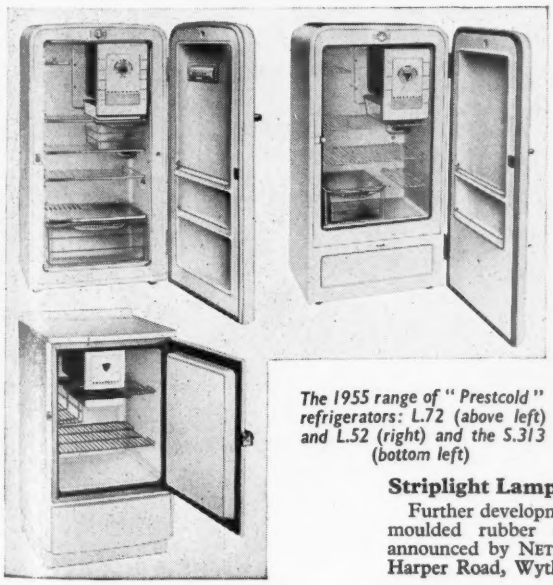
Domestic Refrigerators

The 1955 range of "Prestcold" domestic refrigerators is announced by the PRESSED STEEL CO., LTD., Cowley, Oxford. The new models are a development of the existing range redesigned for greater convenience. All are powered by the "Prestcold" hermetically-sealed refrigeration system which carries a five-year guarantee. They are available in two colours—white and cream.

The smallest model, the S.313, has a capacity of 3·1 cu ft and is of contemporary styling with a slightly bowed front. The 2ft square table-top has been improved by the addition of a spillguard, which prevents liquids and small objects from falling down behind the cabinet and a projecting front ledge, which makes cleaning easier. The one-piece vitreous enamelled liner also simplifies cleaning and the provision of a door to the cooling unit assures a steady temperature within the vibrator. The rearranged door, even when fully opened, remains flush with the cabinet. The price is £48 11s 3d plus £17 11s 9d purchase tax in the United Kingdom.

The L.52 is a medium sized model with a capacity of 5·5 cu ft. Outstanding features include a frozen food locker with two ice trays and a storage capacity of 12 lb. The top and lower shelves fold down to give additional space for large bottles, etc., and the middle shelf is adjustable. Fittings include a glass-topped crispator, automatic interior light and adjustable levelling feet. The cabinet has been restyled and door shelves are fitted. Price is £76 5s 4d plus £27 13s 8d purchase tax.

The largest model, the L.72, has a capacity of 7·2 cu ft and it incorporates all the features of the L.52. In addition to door shelves a butter keeper is provided and the 22 lb frozen food locker has two new designed quick cube release ice trays which make 28 ice cubes in one freezing. The quadrant shaped crispator gives easy access to salads and fruit. The retail price of this model is £91 12s 11d plus £33 6s 1d purchase tax.



The 1955 range of "Prestcold" refrigerators: L.72 (above left) and L.52 (right) and the S.313 (bottom left)

Window De-Mister

A shop window de-misting unit now available from the WARM-GLOW CO., LTD., Leigh-on-Sea, Essex, consists of a specially designed flexible cable about half the thickness of a pencil which is laid or fastened along the front of the window, where it is quite unobtrusive. The heater cable is insulated in a special flameproof plastic and the makers claim that it withstands the gentle heat indefinitely without perishing or cracking.

Model D.M.1 measures 22ft in length and is suitable for 200/220 V while the D.M.2, which measures 25ft, is for use on 230/250 V. Loading is 120 W and the price £1 16s.

Portable Pump

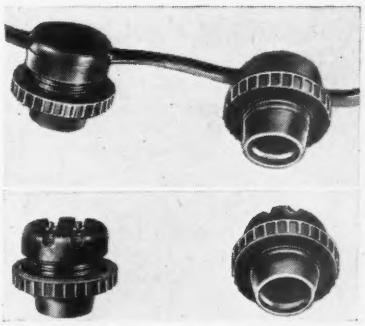
A portable, all purpose, electric pump, claimed to be the first of its kind to be introduced into this country, is now available from the BRITISH CENTRAL ELECTRICAL CO., LTD., 6 & 8, Rosebery Avenue, London, E.C.1. The pump is self priming, has no check valves and is so constructed as to ensure that no liquid remains in the tubes after pumping.

The loading is 260 W at 220 V and weight 15 lb; the length of the "Flux 300" model EX-N is 27in. The body is constructed of aluminium and the pump can be used for all liquids except those that are definitely corrosive or viscous. Standard equipment includes 5 yd of oil- and petrol-proof cable. Each pump is guaranteed for six months.

"Flux 300" portable barrel pump

Striplight Lampholders

Further developments to the range of all moulded rubber striplight lampholders announced by NETTLE ACCESSORIES, LTD., Harper Road, Wythenshawe, Manchester, are two Edison screw holders suitable for sign illumination. They are fitted with a heavy "Bakelite" moulded ring and in one version the body of the holders can be pushed through a suitable drilled hole and clamped into position by means of a front locking ring. The other is a rewirable type.



Top: Nettle striplight lampholders Bottom: One of the rewirable type in two positions (left: exposing the back terminals)

In each case, when the lamp is screwed into position the glass envelope seals itself against the lampholder liner and forms a watertight seal.

Heavy Duty Plugs and Sockets

A range of weatherproof heavy duty plugs and sockets for joining electric cables is now being made by the PLESSEY CO., LTD., Ilford, Essex. They are capable of withstanding rough handling without damage and are available in four basic housings, made of forged aluminium bronze. These are a cable unit, for terminating and anchoring cables; a panel unit, fitted with a flange for mounting in a fixed position, wiring connections being made directly into the rear; a cable coupler, to be used in conjunction with a cable unit when it is desired to join two cables; and a panel mounting coupler, similar to a panel unit except that an outlet and fittings are provided to enable a cable to be connected at the rear.

One of the new range of "Plessey" heavy duty plugs and sockets

The housings are arranged to accommodate either a plug or socket fitting, which are interchangeable, in any of the following three standard sizes, 22-way, 10 A; 4-way, 50 A; and 3-way and 1 earth return, 50 A.

B.A. Spanners

A set of B.A. spanners manufactured to the new British Standard Specification has been introduced by HERBERT TERRY & SONS, LTD., Redditch. Covering six grip sizes, the spanners are suitable for scientific instruments, radio, etc., work. They retail at 2s 6d per set.

INDUSTRIAL NEWS

Fluorescent Lamp Price Reductions

The Electric Lamp Manufacturers' Association announces that due to the popularity of the de luxe warm white fluorescent lamp marketed by its members earlier this year, arrangements have been made for it to be available at the same list prices as other standard colours as from 1st January. The reductions are as follows:—80 W 5ft from 14s 6d to 13s; 40 W 4ft from 13s to 11s 9d; 30 W 3ft from 12s 3d to 11s; 40 W 2ft from 12s 3d to 11s; 20 W 2ft from 11s 9d to 10s 6d; and 15 W 1½ft from 11s to 9s 9d. The prices given do not include purchase tax. The lamps are all available for instant start at 1s each list extra.

Contract Price Formulæ

The British Electrical and Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 18th December is deemed to be 150s 6d. The "cost of material" figures are:—

For electrical machinery and equipment the Board of Trade index figure published on 18th December is 166·9.

For turbo-generating and allied plant: Materials used in mechanical engineering industries, 154·4, blast furnaces and iron and steel smelting and rolling (40 and 41), 146·3. The price of ¼in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 17th December) is 3s 9¼d per lb. Outstanding contracts covered by the B.O.T. intermediate products index: The index figure for intermediate products (18th December) is 363·8.

Diesel Equipment for Angola

Dr. J. W. Bondi, a director of Associated British Oil Engines (Export), Ltd., has just returned from a tour of Brush Group agents in the Belgian Congo and Angola. During his six weeks' tour, Dr. Bondi negotiated orders to the total value of £46,000 with Uniao Comercial De Automoveis Ltda., the Group agents in Luanda and Lobito, for 161 engines and generating sets.

Completion of Manchester-Sheffield-Wath Electrification

On Monday last the final stage of the Manchester-Sheffield-Wath electrification scheme was completed when the 4½ miles section from Sheffield (Victoria) to Rotherwood sidings was brought into use. This enables all freight traffic travelling to the Manchester district from the south and east to be electrically hauled between Rotherwood and Manchester. Since 14th June, when the Woodhead New Tunnel was opened, freight trains have been hauled by steam between Sheffield and Penistone and thence electrically through the tunnel and to and from Manchester.

E.I.B.A. Manchester Branch

The annual general meeting of the Manchester and District Branch of the Electrical Industries Benevolent Association will be held on Monday, 31st January, at the Engineers' Club, Manchester, commencing at 5.45 p.m.

Indian Steelworks

Reuter reports from New Delhi that the Indian Government has accepted in principle an offer by the Soviet Union to set up a steel plant in India with an annual capacity of a million tons.

It is also reported that a British combination of six firms, the Metallurgical Equipment Export Co., is to offer to build a large steelworks at a cost of about £45 million.

B.T.H. Switchgear for Canada

The British Thomson-Houston Co., Ltd., announces that an order has recently been received for six 230 kV, 7,500 MVA type JW419 oil-circuit breakers for the British Columbia Electric Co.'s power transmission system.

Consulting Engineers' Dinner

The annual dinner of the Association of Consulting Engineers is to be held at the Dorchester Hotel, London, W.1, on 21st February (7 for 7.30 p.m.).

Power Convention Exhibition

The Exhibition Committee of the British Electrical Power Convention announces that a limited amount of space will again be available for non-member firms—that is to say, firms who are not identified with participating organizations. Applications should reach Mr. V. W. Dale, director and secretary, British Electrical Development Association, 2, Savoy Hill, London, W.C.2, not later than 15th January.

Rubber and Thermoplastic Cables

New minimum trade prices, to take effect from 1st January, are given in Booklet No. 1 issued to the trade by the Rubber & Thermoplastic Cable Manufacturers' Association, High Holborn House, 52, High Holborn, London, W.C.1.

Birmingham Engineering Centre

To keep interested organizations informed of its various activities, the Birmingham Exchange and Engineering Centre is issuing a monthly *News Letter*. The first number records that since the Centre was opened last June the attendances have averaged 5,900 a month. Details are given of forthcoming meetings and exhibitions at the Centre.

Canadian Aluminium Price Increase

The price of Canadian primary aluminium ingot of 99.5 per cent minimum purity delivered to industrial users in the United Kingdom has been increased by £7 to £163 per long ton as from 1st January.

Nickel in 1954

Dr. J. F. Thompson, chairman of the International Nickel Co. of Canada, has said that the production of nickel by the "free world" in 1954 will reach 390 million lb, 50 million lb more than in 1953. Of this the Canadian production accounts for 320 million lb (against 286 million lb) or 80 per cent of the total. Dr. Thompson expected the output of nickel to reach 415 million lb in 1955. There would probably be more nickel available for "civilian" applications.

Bearings Factory Extension

An agreement has recently been signed between the North Eastern Trading Estates, Ltd., and the Ransome & Marles Bearing Co., Ltd., for an immediate extension to the factory at Annfield Plain.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £163 0s 0d
COPPER, H.C. Electro	ton £295 0s 0d
Fire Refined 99·70%	ton £293 0s 0d
Fire Refined 99·50%	ton £292 0s 0d
COPPER Tubes	lb 2s 9¾d
Sheet	ton £353 5s 0d
H.C. wire and strip	ton £327 0s 0d
LEAD, English	ton £106 5s 0d
Foreign	ton £105 0s 0d
MERCURY	flask £110 0s 0d
TIN, block (English)	ton £695 10s 0d
ZINC, G.O.B. Foreign	ton £84 5s 0d
Electrolytic	ton £88 10s 0d
BRASS Tubes (solid drawn)	lb 2s 3½d
Sheet	ton £281 15s 0d
Wire	lb 3s 2½d
PHOSPHOR BRONZE Wire	lb 4s 3d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 31⅜d—31½d

Non-Ferrous Metal Production

The British Productivity Council, 21, Tothill Street, London, S.W.1, has published "A Review of Productivity in the Wrought Non-Ferrous Metals Industry" (price 1s 6d). This deals practically wholly with copper and copper alloys. It begins with a survey of copper production and exports and proceeds to describe the structure of the industry and its associations. Sections deal with rationalization and standardization, costing, education, work study, incentive schemes and workshop techniques.

An appendix gives some details of the equipment and operations of ten producers of wrought copper and its alloys. This shows the extent of the use of electric furnaces and the improvements in handling methods which have been introduced in recent years.

Firebrick Work Claim

A claim for extra pay while engaged in firebrick construction, repair and maintenance made on behalf of bricklayers, masons and labourers in the employ of the British Electricity Authority has been rejected by the Industrial Court (Award No. 2545). It was contended that extra pay was justified by the arduous and dirty conditions in which the men worked and by the additional skill required for the work. The employers maintained that the agreed rates paid to building workers in the electricity supply industry covered a "broad band" of craftsmanship and it was not conceded that the work in question came outside that broad band.

Electric Cooking Craft

The E.A.W. publication, "Electric Cooking Craft," has been revised by Miss M. E. Bailey, B.Sc., head of the E.A.W. Housecraft Department. It contains all the information required by the beginner in electrical cookery, from the first selection of a cooker to meet individual needs, to hints for obtaining the maximum service from every part, and it includes a variety of recipes. The diagrams of the individual removable parts of the electric cooker enable even the novice to understand her cooker. The "Useful Information for the Housewife" on the back cover provides a ready reckoner for working out electricity consumption. The booklet is obtainable from the Electrical Association for Women, 35, Grosvenor Place, London, S.W.1, price 6d net (post free 8d).

French Trade Directory

From the publishers, 166, Boulevard Saint-Germain, Paris, 6e, we have received a copy of the 1955 Repertoire National du Commerce Extérieur (National Directory of Foreign Trade). This is a most elaborate production consisting of 819 pages (about 9in by 12in) listing in appropriate sections the French manufacturers of all classes of goods. These are given the English and German equivalents in every case and each section has an introduction in French, English and German. A comprehensive trilingual index is included.

In the production of the directory the publishers have had the collaboration of the French Secretariat of Economic Affairs, the National Centre of Foreign Trade and other trade and professional organizations.

Plant for Spain

It is reported that the Metropolitan-Vickers Electrical Co., Ltd., is to receive a contract to provide generating plant for five new thermal power stations in Spain. The agreement awaits the formal approval of the Spanish Minister of Commerce. According to the *Financial Times* the contract, which has been secured in the face of competition from British, American, Belgian, German and Swiss manufacturers, is for six turbo-alternators. Four are of 30,000 kW, one of 15,000 kW and one of 7,500 kW.

The four 30,000 kW turbo-alternators will be installed on the southern coast of Spain where the power situation is not good. Two will be in a power station at Cadiz, one at Almeria and another at Malaga.

The 15,000 kW turbo-alternator will be installed at Palma de Majorca and the 7,500 kW set at Ceuta, Spanish Morocco.

Sale of Unguarded Electric Fires

Four Glasgow firms pleaded guilty at Glasgow Central Police Court recently to exposing for sale electric fires which were unprotected in terms of the Heating Appliance (Fire Guards) Act, 1952, and the Scottish regulations of 1953. All four were admonished. It was stated that the cases were brought as a warning to firms that they were now liable to a fine of £50 if they sold appliances which did not conform to the regulations.

Wild-Barfield Acquisition

Wickman, Ltd., and Wild-Barfield Electric Furnaces, Ltd., announce that agreement has been reached between them whereby the induction heating business of Wickman, Ltd., has been acquired by Wild-Barfield Electric Furnaces as from 1st January. Manufacture of induction heating generators and fixtures will continue as heretofore and continuity of service is also assured for Wickman A.H.F. induction heating units already in use. Manufacture of the plant will continue at the existing address at Oxgate Lane, Cricklewood, London, N.W.2, for the present, after which it will be transferred to the works of Wild-Barfield Electric Furnaces at Watford By-Pass, Watford, Herts, when rearrangement of production facilities will provide space to house the induction heating business. All correspondence in connection with induction heating should, for the time being, be addressed to Cricklewood. Mr. F. L. Gladwin, who has been associated with the Wickman induction heating business since its inception, has been appointed sales manager of the Induction Heating Department by Wild-Barfield Electric Furnaces, Ltd.

Educational

Seven lectures on "Mercury Arc Rectifiers and their Applications" will be given at West Ham College of Technology on Tuesdays, commencing on 25th January. The fee for the course is £2 2s and further particulars can be obtained from the head of the Department of Electrical Engineering of the College, Romford Road, West Ham, E.15. Enrolments will be received up to 17th January.

Greek Machinery Imports

The Greek Ministries of Commerce and Industry have issued Decision No. 85861, dated 2nd December, which revises the list of machinery for the import of which prior approval by the Ministry of Industry is necessary.

The list includes the following:—Poultry breeders (breeding machinery), incubators and mills for poultry food; pumps; cranes, derricks and winches; electric generators and motors up to 20 kW; diesel engines and semi-diesel, marine and for general use up to 20 h.p.

Silicone Manufacture

Albright & Wilson, Ltd., announce that, under arrangements recently completed, the ownership of their silicone manufacturing plant at Barry, South Wales, has been transferred to Midland Silicones, Ltd., the company already established to distribute these products. Albright & Wilson are majority shareholders in Midland Silicones, Ltd., the balance of the shares being held by Dow

The window display by the Liverpool Service Centre which won the Eccles Trophy in the annual competition of the Merseyside and North Wales Electricity Board

Corning Corporation of America. The latter company has been closely associated with Albright & Wilson in establishing the manufacture of silicones in this country, and Midland Silicones, Ltd., will continue to benefit from Dow Corning's experience and research.

Oil-filled Cable for Belfast

A total length of 12,620 yd of 110 kV, 0·3 sq in, three-core, oil-filled cable has recently been supplied and laid by W. T. Henley's Telegraph Works Co., Ltd., for the Belfast Corporation. The cable is paper

Applying the first layers of insulation to one of the joints in the Henley 110 kV 0·3 sq in three-core oil-filled cable

insulated, reinforced lead alloy sheathed, single wire armoured and served, having three 19 mm diameter oil ducts in the spaces between the cores. The cable is composed of two parallel feeders which connect the Belfast West municipal power station with the system of the Electricity Board for Northern Ireland at Donegal substation. For the greater part of the route through the centre of the city the two feeders are in a common trench together with the associated pilot cables. Along the approach road to the new power station, however, where there are several 33 kV feeders, the 110 kV feeders have been laid in separate trenches on opposite sides of the road to ensure that each 110 kV feeder will carry its full specified loading of 75 MVA. The cable has an overall diameter of approximately 4⅜in and weighs 70 lb/yd. The maximum drum length was 320 yd and the gross weight of the drums was between 12 and 13 tons.

Altogether there are 41 normal joints on the feeders. They are contained in tinned copper shells, the sections of which are plumbed together and the coned ends are plumbed on to the cable sheath. The completed joints are protected by reinforced concrete boxes filled with bitumen compound. The feeders are terminated at each end by 0·3 sq in, single-core, paper-insulated, lead sheathed, oil-filled cables jointed to the three-core cable in trifurcating joints of similar construction to the three-core joints except that at one end provision is made for plumbing the sheaths of the single-core cables in separate glands. The oil ducts in the single-core tails are formed by the internally fluted lead sheaths.

The other ends of the single-core cables are connected into sealing ends. At the power station end, these are of the plug-in type which connect into the 75 MVA transformers. At the Donegal substation the tails terminate in outdoor type sealing ends mounted on the switchgear gantry.

Each feeder is fed with oil at three positions. At each end the feed is from pre-pressurized tanks via the trifurcating joints and the intermediate feed is by normal pressure tanks at the highest datum level along the route which conveniently occurs near the mid-point.

The oil alarm is effected by low oil-pressure indicating switches connected to an indicator panel in the new power station. This operates on the multi-relay principle and gives audible and visual alarm for the oil system both of the 110 kV feeders and of other oil-filled cables in the Electricity Department's 33 kV distribution network.

Token Imports from America

The Board of Trade has announced that the token import scheme will continue in 1955 for imports of goods from Canada and the United States of America, but quotas will remain at the same level as in 1954—30 per cent by value of the average exports of the commodity in question to the United Kingdom in 1936-1938. The scheme will cover the same goods as in 1954 except for the reinstatement of a few minor items that were deleted at the end of 1947, one of them being portable electric generators. The total value of goods imported under the scheme is about £3 million a year.

Details of the method of applying for licences are given in Notice to Importers No. 704 issued by the Import Licensing Branch of the Board of Trade, 43, Marsham Street, London, S.W.1.

Radio Servicing Examination

The Radio Trades Examination Board, 9, Bedford Square, London, W.C.1, announces that the closing date for entries for the radio servicing certificate examination will be 1st February and, for the television servicing certificate, 15th January.

Revised Maintenance Arrangements

Carlisle Corporation has decided to discontinue the present system of electrical maintenance work on housing schemes being carried out by electrical contractors on a rota system. As from 1st February all maintenance work will be done by the North Western Electricity Board. Consideration is also to be given to the method of carrying out maintenance work on other Corporation property.

Calendars

The calendar received from Cable & Switchgear (Farnley) Installation, Ltd., has large monthly sheets with bold figures.

Eric Staines (Electricals), Ltd., have sent us a neat desk calendar.

A picture of the Elizabethan period surmounts the calendar of Fitter & Poulton, Ltd., which has monthly slips.

The neat desk calendar of Nalder Bros. & Thompson, Ltd., shows one month with bold figures on each card, and the preceding and following months in smaller type.

Large monthly sheets form the calendar of G. S. Peckham & Co., Ltd.

Trade Announcements

The **London Electric Wire Co. & Smiths, Ltd.,** and its associated companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., and the Vactite Wire Co., Ltd., announce the opening on 10th January of branch offices and stores at Lewcos House, Cardiff Road, Reading, where they will maintain comprehensive stocks of wires and cables to cover the requirements of electrical apparatus manufacturers, contractors and retailers in the Berks, Bucks and Oxfordshire area.

The address of **C.W.C. Equipment, Ltd.,** is now Acorn Works, Kings Grove, Maidenhead, Berkshire (telephone: Maidenhead 2275).

The Scottish office of **Smiths Industrial Instruments, Ltd.,** is now 123–145, North Street, Glasgow, C.3 (telephone: Glasgow Central 3972–8).

The **Riley Stoker Co., Ltd.,** has opened a new branch office at 43, Burton Road, Melton Mowbray (telephone: Melton Mowbray 495).

CATALOGUES AND LISTS

COOKERS.—Illustrated broadsheet dealing with the B.N.E. "C.90" electric cooker. —BRITISH NATIONAL ELECTRICS, LTD., Charlton, S.E.7 (E.C.16).

Folder illustrating the range of "Creda" cookers and an eight-page recipe booklet.—SIMPLEX ELECTRIC CO., LTD., Creda Works, Blythe Bridge, Staffs.

GENERATION.—44-page illustrated catalogue of electrical plant for power generation, including alternators, supervisory equipment, pump motors, etc.—GENERAL ELECTRIC CO., LTD., Magnet House, London, W.C.2.

HEATING.—Catalogue illustrating the "Isomantles" range of electric surface-heaters for metal and glass plant.—ISOPAD, LTD., 30–32, Rosemont Road, London, N.W.3.

INDUSTRIAL CLOTHING.—Seven leaflets describing a recently extended range of "North" fabric-supported p.v.c. gloves and clothing.—JAMES NORTH & SONS, LTD., Godley Mills, Hyde, Cheshire.

LIGHTING FITTINGS.—Three-page folder illustrating a range of tubular fluorescent fittings, together with price list.—GORDON & SMITH, Sidmouth Mews, Gray's Inn Road, London, W.C.1.

METAL DETECTORS.—Technical catalogue describing the "MD" electronic metal detector.—METAL DETECTION, LTD., Mosely Street, Birmingham, 12.

SPEED REDUCERS.—Catalogue of the new torque-arm shaft mounted speed reducers. —J. H. FENNER & Co., LTD., Marfleet, Hull.

Appliance Manufacturers' Expansion

Morphy-Richards' Eighteen Years of Progress

A general view of the iron assembly lines

EIGHTEEN years ago the first Morphy-Richards heat controlled electric iron was made in a small farm building at St. Mary Cray, Kent. To-day not only are these irons produced at the rate of about twenty a minute and supplied to nearly a hundred countries but the company is also manufacturing in large quantities several other products such as automatic toasters, fires, convection heaters, panel heaters, hairdryers and the latest item, steam or dry irons.

More than 1,500 employees are now engaged in the organization and this number will be very considerably increased when further proposed factory extensions are completed in eighteen months' time.

This expansion, which is all the more remarkable when it is remembered that about ten of the years were "lost" on account of the war and its aftermath of restrictions, is to a very large extent due to the enterprise and foresight of the two founders (now joint managing directors) of the company, Mr. D. W. Morphy and Mr. C. F. P. Richards.

Production arrangements are considerably facilitated by the policy of distribution of their products completely through wholesalers, with whom there is collaboration at all stages. Every six months the wholesalers make known their requirements on a requisition basis and this makes it possible to stabilize the level of production throughout the year.

About six months ago a representative was engaged to go out to any part of the world so that the company can assess the month by month position in overseas markets. Ninety-five countries are now being supplied with Morphy-Richards products and subsidiary companies have been established in Canada, Australia, South Africa and Argentina.

About 40 per cent of total production is now being exported and this figure is believed to include about 95 per cent of the total United Kingdom exports of automatic irons. Norway is in fact said to import Morphy-Richards irons exclusively at the rate of 100,000 a year, which in view of the fact that the population is 2½ million is indeed an achievement. The company can also claim to be one of the few appliance manufacturers having substantial business in North America. About 80 per cent of Canadian dealers handle its products and between them they have up to now taken $3¼ million worth, including 200,000

Setting the thermostats on steam or dry irons and (right) completing the assembly of "Atlantic" light weight irons

toasters. In the last financial year export sales to Europe have totalled £230,000, to the Far East £265,000, to North, Central and South America £135,000 and to Africa £42,000. While there have been no appreciable sales direct to the United States, there has been considerable infiltration via the American forces stationed in Europe, who have bought £40,000 worth of the company's goods.

To meet the growth of demand for appliances there has been continuous factory expansion. The original premises soon became inadequate and in 1938 on an adjoining site the West factory was opened with a floor area of 40,000 sq ft. About eighteen months ago twice this production space was made available in the East factory and in 1956 the South factory should be completed, again doubling the capacity and bringing the total floor area to nearly a quarter of a million sq ft. Even then, however, it is anticipated that there will still be a shortage of room to cater for contemplated developments.

The reorganization of the factory involved by the opening of the East factory has now been completed, the process having been undertaken gradually over a period of months in order not to interfere with production. The West factory is now used primarily for the main assembly of the convectors, panel heaters, hair dryers, and " Cray " reflector fires, as well as for making elements and certain other components for irons. A high proportion of the components, such as mouldings, diecastings and pressings, are bought in, thus leaving the maximum space available for assembly work. The larger pressings for the convectors, for instance, are stamped out elsewhere and require only forming to shape on jigs and spot welding. A small press shop is employed mainly on convector bodies. Besides the original spray shop a new electrostatic spray unit has recently been installed, largely for the painting of the outside of the convectors, which travel on a continuous conveyor from the degreasing plant, through the paint booth and drying oven, direct to the assembly lines.

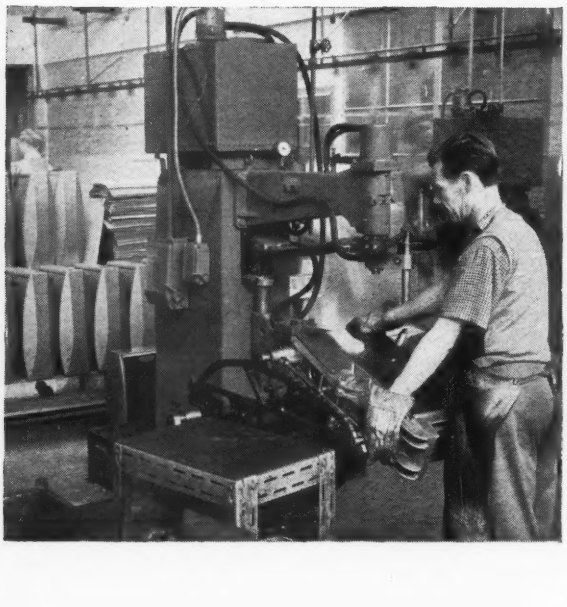
In the hairdryer assembly section the rotors are built up from pressings, the spindles inserted, the outside diameters turned to size and the ends faced. After the stators have been built up they are sent out for winding and return with coils in position ready for impregnation. The motors are then assembled on jigs and pass down chutes for inspection. At present these are transported on trays but shortly a conveyor system is to be introduced. The heaters and motors are inserted into the " motor halves " of the plastic bodies. With the flexibles and fans added the units are screwed up, inspected and given flash, running and quietness tests before packing.

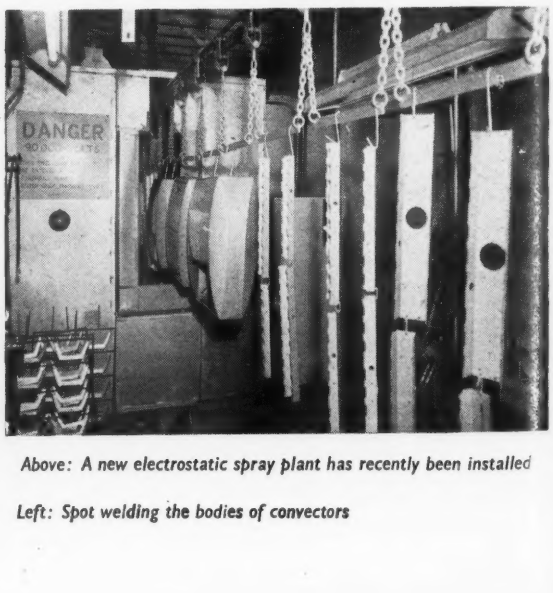
At the front of the East building, now in full production, are offices including a personnel room, welfare department and discussion rooms. On the first floor is the service department, while the main factory area is occupied with the assembly of " Senior," " Atlantic " (light weight), steam, travel and toy irons and toasters. At present nine self-contained assembly lines are laid out for the manufacture of " Senior," " Atlantic " and steam irons, but re-allocation of these lines can be carried out rapidly to meet changes in demand. Production is not helped by the fact that there are no fewer than 1,100 variations required for the export market alone.

Assembly has been largely mechanized with overhead conveyors supplying some of the components such as the cowls, as well as the boxes. The sequence of operations follows a logical course starting with the soleplate and finishing with the control knob, all the completed units undergoing routine tests and a certain proportion receiving a secondary check under a quality control scheme covering all products.

The elements employed in the " Atlantic " and steam irons are of the embedded type which ensure an almost indefinite life: in fact " Atlantic " irons have successfully

" Cray " fires undergoing tests





Above: A new electrostatic spray plant has recently been installed

Left: Spot welding the bodies of convectors

Adjusting the timing element on automatic toasters

The assembly line for hairdryers

survived life tests equivalent to seventeen years' use. After winding, these elements have their ends brazed and the terminal ferrules added. They then undergo a presetting operation to shape them ready for insertion in the soleplates. The latter, which are castings, first have the element recesses filled with a cement compound. After the elements have been inserted further dry cement compound is introduced. The cement is then compressed round the elements and sealing plates are sheared into position to give airtight joints. Drying out of the completed units is carried out in three stages.

The successful production of the automatic toaster has been by no means a simple matter. It has been necessary to design it so that it will work equally well on all types of bread (" Procea " bread requires only a quarter of the time of wholemeal) and to ensure that the second and subsequent slices are just as well toasted as the first despite the fact that the first slice may require 2½ minutes, the second 1½ minutes, and the third 1 minute and so on. The timing must in fact be accurate to 5 seconds and a dash-pot mechanism is necessary to slow down the rate of ejection. The frames are welded together from cadmium plated steel, the cowls being finished in chromium on nickel. There is a large automatic plating plant available for treating these and all other components used in the factory requiring special finishes.

We are grateful to Mr. Morphy and Mr. Richards for the help they have given us in the preparation of this article.

NEWS FROM BRAZIL

ALTHOUGH the Brazilian Government's austerity programme provides for a drastic reduction of public expenditure, electrification plans will not be interfered with. The law creating the Federal Electrification Fund (see "Electrical Review," 31st July, 1953) was sanctioned in September. New concessions to exploit water power continue to be granted and loans authorized by the Bank for Economic Development to assist small supply companies in the interior. An additional loan of $(U.S.)8,500,000 is now being negotiated with the World Bank to finance the second stage of the Paulo Afonso expansion programme.

The first stage was completed in November, at a cost of £35,180,000. It included the building of some 500 miles of roads to this remote, uninhabited region, as well as workmen's dwellings, hospital, church, schools, recreation centres, restaurants and repair shops. An artificial town, with a population of over 23,000, now exists around the Paulo Afonso Falls. Two dams, with an overall length of 4,230 metres, converge near the canyon in the form of a "V." Three 104 m tunnels convey the water to the underground power station, whence it returns to the river by way of a tunnel 180 m long and 10 m in diameter. An underground gallery, 60 m long by 16 m wide and 30 m high, houses three 83,000 h.p. turbines, each coupled to a 60,000 kW generator. The voltage is stepped up from 13·8 to 220 kV by two 67,000 kVA banks of three single-phase transformers. Power at 220 kV is transmitted from the outdoor substation by steel-cored aluminium conductors to Recife, 405 km to the north, and Salvador, 475 km to the south.

Work is about to start on a second power station, similar to the first, to supply additional towns in Pernambuco and Bahia and others in Paraiba, Alagoas and Sergipe. The system will then cover the whole of North-East Brazil, including Rio Grande do Norte, Piaui and Ceara.

The Brazilian Traction Light & Power Company inaugurated a new thermal station at Piratininga, Sao Paulo, on 15th November. The equipment, for which the World Bank advanced $(U.S.)18,790,000, includes two 100,000 kW generators, built by the American General Electric. The boilers are oil-burning but the installation is arranged to use either oil or coal. On 28th November the same company brought into operation the 450,000 h.p. Nilo Pecanha underground hydro-electric station, formerly known as Forcacava, at Ribeirao das Lages. It is also building an underground gallery 120 m long by 20 m wide and 42 m high adjoining its Cubatao station to house six 60,000 kW generators. The first two units should begin working by June next and two others within the following twelve months.

Financial Section

STOCKS and SHARES

DESPITE the labour uncertainties, the majority of the popular industrial shares finished last year at, or not far from, the highest prices ever quoted for them. Measured by the price indices, the average improvement was of the order of 40 per cent. Government securities, under the influence of dearer money talk, finished well below their best, but with a net average gain of some 3 per cent over the period.

Stock Exchange markets entered the New Year with some anxious matters in immediate prospect, and with a General Election beginning to loom in the background. Outside the gilt-edged market, nevertheless, confidence seemed to be uppermost, with hopes centred on a persistence of active trade at large, on a good Budget and a fine season of company dividends and results in the spring. This year's tables of comparison display the continued popularity of electrical investments of all descriptions.

British Electricity Stocks

Aided by the further reduction of Bank Rate from 3½ to 3 per cent in May, the gilt-edged market made steady headway until checked by the talk of a return to dearer money in the last month of the year. That course began to be advocated in some places as a precaution against the revival of inflationary tendencies. Nevertheless Government securities retained useful gains on balance. All four of the British Electricity Authority's issues finished last year between four and five points to the good. It gives the measure of the change in gilt-edged market conditions to note that the 4¼ per cent British Electricity stock 1974/79, of which an issue was made in August, 1953, at 100, is now quoted at about 108⅛.

Siemens and A.E.I.

Holders of Siemens Bros. £1 ordinary have until 24th January (although the time may be extended) to make their decision on the offer for their shares from Associated Electrical Industries. The latter company already holds a little under a fifth of Siemens £3,675,000 ordinary stock, and is offering to acquire the balance by an exchange on the basis of seven A.E.I. for ten Siemens shares. One of the conditions of the offer is that it shall be accepted to the extent of not less than 90 per cent, or such lesser proportion as may be agreed upon. Since the proposal, Siemens ordinary have been quoted at about 43s, and A.E.I. at 62s 6d, these prices being close to the 10-for-7 basis of the offer. Acceptance is recommended by the directors of Siemens, who intend to make the exchange in respect of their own holdings.

Radio Group

Some of the best performances of the year are to be noted in the group still inadequately described as "radio" shares. Relaxation of hire-purchase

Three Weeks' Price Changes

Company or Board	Nom. Value	Middle price 3rd Jan.	Three Weeks' Rise or Fall	Dividend: Previous	Dividend: Last	Yield %	1954: High-est	1954: Low-est
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	95	−½	3	3	3 3 2	97	88⅞
Brit. Elec. 1974/77	100	93½	−1½	3	3	3 3 6	96½	87½
Brit. Elec. 1976/79	100	98½	−1	3½	3½	3 11 1	101½	93 3/16
Brit. Elec. 1974/79	100	103½	−½	4¼	4¼	3 18 0	111½	103 3/16
Overseas Electric Supply								
Calcutta Elec.	£1	22/-	−6d	6†	6†	5 9 0†	24/6	18/7
East African Power	£1	23/-		7	7	6 1 9	23/4	19/6
Nigerian Elec.	£1	22/6	−1/6	10	10	8 17 10	25/-	23/6
Palestine Elec. "A"	£1	21/-		Nil	Nil	—	21/-	16/-
Perak Hydro-Elec.	£1	20/-	+1/6	6	10	10 0 0	20/-	13/9
Equipment and Manufacturing								
Aberdare Cables	5/-	13/9	+6d	25	12½*	4 11 0	14/3	8/1
Aerialite	1/-	11/9	−3d	88⅛	88⅛	7 10 3	14/6	10/9
Allen, W. H.	£1	78/3		15	20	5 2 3	78/6	50/-
Aron Elec. Ord.	£1	56/6		20	15	5 6 4	60/-	43/-
Assoc. Elec. Ord.	£1	62/6	+2/6	20	11¼*	3 12 0	62/6	41/6
Automatic Tel. & El.	£1	70/9	+9d	15	15	—	73/-	57/3
Babcock & Wilcox	£1	69/-	−1/-	18	12*	3 9 6	76/3	47/3
Baldwin, H. J.	2/-	4/6	−6d	20	20	8 17 9	5/6	3/9
Bakelite	10/-	28/3		12½	12½	4 8 6	32/-	23/6
British Aluminium	£1	40/9	+2/-	12	10	4 18 3	41/-	33/9
B.I. Callender's	£1	48/6	+2/3	10	10	4 2 6	52/-	37/9
B.I. Callender's 6% Pref. ...	£1	26/3		6	6	4 11 6	26/6	24/3
British Thermostat	5/-	26/3		35	27½*	—	28/-	12/-
British Vac. Cleaner	5/-	14/3		15	25	8 15 6	14/6	11/6
Brook Motors	10/-	42/6		20	20*	—	45/6	29/3
Brush Ord.	5/-	7/6		4	6	4 0 0	8/3	3/6
Bulgin, A. F.	1/-	4/3		30	30	7 1 3	4/3	3/2
Burco	5/-	21/-	+1/3	35	25*	5 19 0	21/6	12/1
Chloride El Storage "A" ...	£1	66/-		20	12½*	3 16 3	68/6	46/6
Clarke Chapman	£1	70/-		17½	20	—	73/-	47/6
Cole, E. K.	5/-	20/-	+2/-	25	27½	—	20/-	11/6
Cossor, A. C.	5/-	9/6		10	10	5 5 3	11/-	7/-
Crabtree	10/-	30/6		17½	20	6 11 2	32/-	23/9
Crompton Parkinson Ord. ...	5/-	16/9xc		20	20	—	22/-	14/-
De La Rue	5/-	23/9	+3/9	Nil	20	4 4 0	23/-	12/3
Decca	4/-	56/6	+8/9	35	56½*	3 19 9	56/6	32/-
Desoutter	5/-	26/3	+6d	18	20	3 16 4	26/6	16/1
Dewhurst	2/-	7/6	+6d	19	24	6 8 0	7/6	5/1
Dictograph Tel.	2/-	7/3	+6d	20	20	5 10 4	8/-	5/2
Dubilier Condenser	1/-	4/6		25	25	—	5/3	3/3
E.M.I.	10/-	26/6	+5/-	8	10	3 15 6	27/9	11/3
Electrical Components	5/-	16/3		20	20	6 3 0	16/3	10/9
Elec. Construction	£1	35/-xc		15	15	4 5 9*	35/-	26/6
Enfield Cable Ord.	£1	22/6	−1/3	5	Nil	Nil	26/3	16/6
English Electric	£1	55/-	+1/3	15	10*	3 12 9	59/-	38/-
English Electric 3½% Pref. ...	£1	16/9		3½	3½	4 9 7	16/9	15/3
Ericsson Tel.	5/-	32/9	+1/-	22†	25†	—	33/9	22/9
Ever Ready	5/-	23/6	−6d	35	40	—	26/3	17/9
Falk Stadelmann	£1	48/-	+1/-	15	15	6 5 0	48/6	36/6
G.E.C. Ord.	£1	58/9	+1/3	11¼	12½	4 5 0	60/-	37/6
G.E.C. 6½% Pref.	£1	28/9		6½	6½	4 10 6	28/9	26/6
General Cables	5/-	17/-xd		30	30	8 16 6	18/-	16/3
Greenwood & Batley	£1	55/-		17½	17½	6 7 3	55/-	40/3
Hackbridge Cable	5/-	15/3	+6d	20	20	6 11 2	15/9	11/3
Hackbridge & Hewittic	5/-	25/-		20	25	5 0 0	25/-	16/10
Hall Tel. Acc.	10/-	12/-		10	10	8 6 8	13/-	10/6
Heatrae	2/-	5/3		12½	12½	4 11 0	5/6	4/-
Henley's	10/-	18/-		10½	10½	5 16 8	22/-	15/6
Holophane...	5/-	17/3	−3d	20	25	7 5 0	18/-	13/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

restrictions and the effect of this upon radio and television sales provided the shares with a special fillip. Apart from this, investment seems to become increasingly alive to the possibilities existing in the application of electronic discoveries to the field of business and industry. Dividends and results reported by the companies concerned were virtually all progressive. Under these stimuli a number of the most popular issues doubled in value. Decca

in Electrical Investments

Company or Board	Nom. Value	Middle price 3rd Jan.	Three Weeks' Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.								
Hoover	5/-	45/3	+1/-	25	45	4 19 5	51/-	26/3
I.C.I.	£1	41/9	+1/9	13	15	3 11 9*	43/6	26/6
Intl. Combustion	5/-	26/9	+6d	15	20	3 14 9	30/-	14/6
Johnson & Phillips	£1	45/6		15	15	6 11 9	52/6	45/6
Lancashire Dynamo	£1	55/-		12½	14	5 1 10	59/6	43/-
Laurence, Scott	5/-	14/9xc		15	20	3 7 9*	14/9	7/-
Lister, R. A.	£1	31/-	−1/-	9	12	—	33/-	22/6
London Elec. Wire	£1	51/-		15	10*	3 18 6	54/-	38/-
Lucas, J.	£1	44/6	+1/-	10·8	7½*	3 7 6	49/-	25/3
Marryat & Scott	2/-	9/6		22½	25	5 5 3	9/6	5/11
Mather & Platt	£1	48/-	+1/-	12½	15	—	53/-	32/-
Metal Industries	£1	32/6	−1/-	12	9	5 10 9	42/3	29/6
Midland Elec. Mfg.	£1	43/9		15	15	—	43/9	31/6
Morphy-Richards	4/-	26/6		40	35*	5 5 9	26/6	11/4
Murex	£1	51/6	+1/-	15	15	5 16 6	57/-	49/-
Newman Ind.	2/-	2/4½		10	10	8 8 5	2/6	2/-
Oldham & Son	1/-	3/3		17½	17½	5 7 9	3/4	2/5
Parnall (Yate)	5/-	10/4½	−4½	6	8	3 17 2	11/-	4/3
Parsons, C. A.	£1	57/6		12½*	7½*	2 12 3	60/-	38/1
Plessey	10/-	66/3	+6/3	30	20*	3 2 0	64/-	37/10
Pye Deferred	5/-	35/6	+2/-	20	20*	2 16 3	37/-	15/7
Revo	10/-	15/-	+6d	27½	9*	6 0 0	20/3	14/-
Reyrolle	£1	88/9	+1/3	12½	13¾	3 2 0	92/6	66/-
Rheostatic	4/-	15/3		19	20	5 5 0	15/9	11/-
Richardsons Westgarth	5/-	11/3	+3d	15	15*	6 13 4	12/3	6/6
Scottish Cables	4/-	19/3	+1/3	20	27½	5 14 3	21/9	12/1
Siemens Ord.	£1	43/-	+1/9	10	10	4 13 0	44/-	33/9
Smith (England), S.	4/-	17/6	+1/3	15	17½*	4 0 0	17/6	7/8
Southern Areas	£1	31/3	+1/3	6	7½	4 16 0	32/6	17/6
Strand Elec.	5/-	9/3		17½	17½	9 9 3	10/3	8/3
Sturtevant	5/-	21/6	−6d	18·1†	18·9*†	—	22/9	14/6
Sun. Elec.	£1	33/9	+2/-	15	15	8 17 9	33/9	27/6
Switchgear & Cowans	5/-	11/9		22½	10	4 5 0	13/7	9/9
Taylor Tunnicliff	5/-	11/3		25	12½*	5 11 0	12/4	10/7
T.C.C.	10/-	41/3		20	30*	—	41/3	21/3
T.C. & M.	£1	37/6	+4/-	10	8½*	4 10 9	37/6	30/3
Telephone Mfg.	5/-	9/6		10	10	5 5 3	9/6	7/6
Thorn Elec.	5/-	29/6		12½	20	3 7 9	30/6	13/3
Thornycroft	£1	36/6xc	+6d	25	25	—	39/6	26/6
Tube Investments	£1	81/3		15	17½	3 16 2	81/3	60/3
Vactric	5/-	24/6	+2/9	Nil	10	2 0 10	24/6	7/6
Veritys	5/-	9/-		10	12½	6 19 0	10/6	5/-
Walsall Conduits	4/-	52/6		70	70	5 6 8	52/6	44/-
Ward & Goldstone	5/-	42/6	+6d	45	50	—	43/6	21/-
Watford	2/-	6/9	+3d	25	22½*	—	7/3	4/7
Westinghouse Brake	£1	85/-		16	18	4 4 9	86/3	60/9
West, Allen	5/-	18/-	+6d	15	17½	4 17 3	19/6	12/7
Wolf Electric	5/-	16/6	−6d	15	17½	5 6 0	17/6	11/-
Trusts, Transport and Communications								
Anglo-Am Tel.:								
A Ord.	100	88		6	6	6 16 4	89½	80
Ord.	100	54½		3¾	3¾	6 17 6	55½	52
Anglo-Portuguese	£1	24/9		—	8	6 9 4	25/9	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	20/6		35	50	—	24/-	13/-
Cable & Wireless:								
Ord.	£1	41/3	+1/3	8	9	4 7 3	42/9	26/2
4% Loan	100	98½		4	4½	4 1 3	98½	95½
Calcutta Trams	£1	20/6		2½†	6†	5 17 0†	24/6	17/1
Cape Elec. Trams	£1	17/-		5½	7	8 4 9	17/6	12/4
Marconi Marine	£1	34/-	+6d	10	10	5 17 8	35/-	27/6
Oriental Tel. Ord.	£1	101/3	+3/9	16	16	—	101/3	82/6
Telephone Props.	£1	87/6	−2/6	—	—	—	92/6	74/6
Telephone Rentals	5/-	10/9	+3d	10	10	4 13 0	11/-	9/-

capital was reorganized, and the comparison below does less than justice to the actual performance of the shares:—

Share	End of Year 1953	End of Year 1954	Rise
Cole, E. K.	11/9	20/-	8/3
Cossor, A. C.	7/-	9/6	2/6
Decca	30/6 (*a*)	56/6	26/-
E.M.I.	11/9	26/6	14/9
Ever Ready	16/9 (*a*)	23/6	6/9
Plessey	36/6 (*a*)	66/3	29/9
Pye	16/3	35/6	19/3
Thorn	14/-	29/6	15/6

(*a*) In this and the following tables prices are adjusted for scrip distributions (but not for cash issues) during the year.

Electrical Equipment

The extent of the appreciation shown below in the value of A.E.I. and English Electric shares is fairly representative of the year's progress in the top strata of the industrial markets. General Electrics did particularly well for holders, part of the credit for this being given to the improvement of trade in the so-called "consumer" categories of electrical products. C. A. Parsons and A. Reyrolle, which made some of the best showings in 1953, were again right in the van of the advance. All but two of the companies in the following table paid increased dividends:—

Share	End of Year 1953	End of Year 1954	Rise
A.E.I.	43/9	56/6	12/9
Crabtree	23/9	30/6	6/9
Elec. Construction	27/- (*a*)	35/-	8/-
English Electric	40/-	55/-	15/-
G.E.C.	38/9	58/9	20/-
Lancs. Dynamo	43/9	55/-	11/3
C. A. Parsons	38/3	57/6	19/3
A. Reyrolle	66/-	88/9	22/9
Allen West	13/-	18/-	5/-
Westinghouse	62/6	85/-	22/6

Cables & Telephone

Shares in the principal manufacturers of electric cable and telephone equipment retained their popularity. Prices advanced with less reserve than in the previous twelvemonth, which was disturbed for the cable makers by the restoration of a free market in copper. Dividends in these groups were mostly unchanged, but several attracted attention as being particularly conservative in relation to the rates of earnings available for distribution:—

Share	End of Year 1953	End of Year 1954	Rise
Aberdare	8/-	13/6	5/6
Automatic Tel.	55/9 (*a*)	70/9	15/-
B.I.C.C.	38/3	48/6	10/3
Dictograph	5/6	7/3	1/9
Enfield Cables	17/-	22/6	5/6
Ericsson	23/9 (*a*)	32/9	9/-
Henley's	16/-	18/-	2/-
L.E.W.	38/-	51/-	13/-
T.C. & M.	31/-	37/6	6/6
Telephone Mfg.	7/9	9/6	1/9

Miscellaneous Markets

Shares connected with the supply of accessories to the motor industry were in high favour as a reflection of the latter's great expansion programmes. Equally well supported were invest-

ments in the firms producing electrical household devices and equipment. Demand has persisted for shares in the heavy sides of engineering concerned with power-raising plant:—

Shares	End of Year 1953	1954	Rise
Babcock & Wilcox	47/6	69/-	21/6
B.E.T.	12/6 (a)	20/6	8/-
Brush	4/3	7/6	3/3
Cable & W.	27/- (a)	41/3	14/3
Chloride Elec.	49/-	65/6	16/6
De La Rue	13/-	23/-	10/-
Hoover	25/6	45/3	19/9
I.C.I.	27/- (a)	41/9	14/9
Lucas	25/9 (a)	44/6	18/9
Morphy-Richards	11/- (a)	26/6	15/6
Smith, S.	7/10 (a)	17/6	9/8
Tube Investments	62/-	81/3	19/3
Tel. Condenser	21/3 (a)	41/3	20/-

REPORTS AND DIVIDENDS

Allen West & Co., Ltd., are applying to the Capital Issues Committee for permission to increase the authorized capital from £1,250,000 to £2,000,000 and for permission to make a scrip issue by capitalization of reserves on the basis of one new ordinary share of 5s for every two 5s stock units held.

The Morgan Crucible Co., Ltd., has declared an interim dividend of 6 per cent (against 3¾ per cent). For 1953-54 the total dividend was 14 per cent (against 12½ per cent), and in his review for that year, Mr. P. Lindsay said that a more even division between interim and final dividends might be welcomed by stockholders.

W. H. Allen, Sons & Co., Ltd., have declared an interim dividend of 5 per cent (unchanged).

Bennis Combustion, Ltd., has declared an interim dividend of 5 per cent (unchanged).

New Companies

Pinner Investments, Ltd.—Registered 15th December. Capital £5,000. Hire purchase financiers, electrical engineers and contractors, radio and television engineers and service agents, etc. Directors: J. S. Taylor and Sheila M. Taylor. Regd. office: Ranworth, 49, The Drive, Harefield Place, Uxbridge.

J. F. Hobson & Co., Ltd.—Registered 14th December. Capital £1,000. General and electrical engineers, etc. Directors: J. F. Hobson, W. E. Meyer, and A. J. Greaney. Regd. office: 926, North Circular Road, Cricklewood, N.W.2.

Associated Electrical Industries Overseas, Ltd.—Registered 18th December. Capital £1,000. To acquire and hold shares, stocks, etc.; power is also taken to carry on business of electrical and mechanical engineers, etc. The first directors are to be appointed by the subscribers. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

Metind, Ltd.—Registered 18th December. Capital £100,000 in £1 shares. Electrical engineers and electricians, mechanical and general engineers, manufacturers of and dealers in switchgear, control gear, starters, dynamos, generators, fans, motors, motor generators, armatures, magnetos, batteries, etc. The first directors are not named. Solicitors: Tindal, Oatts & Rodger, 113, St. Vincent Street, Glasgow, C.2.

Abbey Engineering Services, Ltd.—Registered 11th December. Capital £10,000. Designers and developers and manufacturers of aircraft components and mechanical, electrical and other equipment of all kinds, including radio transmitting and receiving apparatus, television apparatus and radar equipment, etc. Directors: M. H. Goldsmith, G. C. Bourne and J. W. French. Regd. office: Abbey Mills, Nuneaton.

Bankruptcies

R. W. Hembrow, 47, St. Mary's Road, Ealing, London, W.5, electrical engineer.—Public examination 16th February at Bankruptcy Buildings, Carey Street, London, W.C.2.

G. R. Rosvall, Seafield Holiday Camp, Westward Ho! Devon, engineer and electrician lately residing and carrying on business at the Corner House, St Giles, Torrington, Devon.—Last day for receiving proofs for dividend 8th January. Trustee, Mr. G. W. Sisman, 12, Pennsylvania Road, Exeter, Official Receiver.

WESTERN GERMANY'S ELECTRICAL IMPORTS

IMPORTS of electro-technical products including machinery into Western Germany last year were valued at DM.101 million, an increase of about one-third as compared with the year 1952.

The advance spread throughout nearly all groups, the only important exception being a 50 per cent decline in electrical equipment for vehicles. In the trade as a whole, the Netherlands accounted for nearly 30 per cent of the total value and Switzerland for about 20 per cent. The share of the United Kingdom was only DM.9,707,000, DM.1 million less than in the previous year; radio apparatus was her only noteworthy line of increase. The accompanying table shows the principal items and supplying countries with notes of increase or decrease on 1952. (£1 = DM.11·76.)

Class of Goods	1953 DM(000)	Inc.or dec. on 1952 DM (000)
Generators, motors, transformers, convertors, etc., up to 10 kW	2,081	+ 533
From Saar	918	+ 255
,, *Netherlands*	299	− 26
,, *Switzerland*	433	+ 89
Ditto, 10 to 1,000 kW	5,724	+ 1,746
From Saar	2,459	+ 350
,, *Switzerland*	2,145	+ 1,272
Ditto, over 1,000 kW	837	+ 491
Generator sets	253	− 32
Transformers and choking coils	2,233	+ 543
From Switzerland	493	− 479
,, *Netherlands*	1,151	+ 800
Current regulators	606	+ 123
Electromagnetic apparatus:		
Magnets	688	*
From Austria	213	*
Primary coils and primary batteries	403	+ 148
From U.K.	372	+ 169
Accumulators	25	− 129
From France	3	− 107
Elec. operated tools and machine tools	862	+ 431
From Switzerland	581	+ 369
Vacuum cleaners and floor polishers, household	602	− 260
From U.K.	62	− 148
,, *Sweden*	378	− 210
Washing, etc., machines, household	1,529	+ 958
From U.K.	1,299	+ 915
Fans, up to 600 W	123	+ 87
Other household appliances, up to 15 kg	773	+ 293
From U.K.	213	− 175
,, *Switzerland*	526	+ 441
Shavers and haircutters	5,024	+ 1,056
From Netherlands	3,542	+ 1,546
Ignition equipment for i.c. engines, semi-diesel or diesel engines	1,139	+ 669
From U.K.	65	− 91
,, *Sweden*	608	+ 471
Elec. equipment, n.e.i., for cycles, motor vehicles, aircraft, ships, etc.	1,643	− 1,680
From France	231	− 29
,, *U.K.*	283	− 15
,, *Italy*	744	− 1,110
Elec. welding apparatus and parts	3,456	*
From U.K.	950	*
,, *Sweden*	371	*
,, *Switzerland*	1,093	*
Elec. ovens, industrial and household	857	*
From Switzerland	418	*
Pressing irons	9	− 1
Other heating appliances and parts	1,207	− 87
From Netherlands	603	+ 68
,, *Switzerland*	291	+ 43
Arc lamps	198	+ 79
Portable elec. lamps with batteries and the like	19	+ 7
Radiological apparatus and accessories	1,948	+ 124
From Netherlands	990	− 128
Electromedical, surgical and dental apparatus	1,058	+ 263
From Sweden	94	− 328
,, *Netherlands*	633	+ 542
Telephonic apparatus	827	+ 249
From Netherlands	269	+ 25
Telegraphic apparatus	297	− 46
From U.S.A.	92	− 119
,, *Netherlands*	112	+ 11
Microphones, amplifiers, loudspeakers, etc.	1,561	+ 418
From Netherlands	1,307	+ 247
Elec. hearing aids	752	− 23
From U.K.	44	− 21
,, *U.S.A.*	84	− 140
,, *Netherlands*	323	+ 221
Radio apparatus	9,486	+ 4,407
From U.K.	1,929	+ 1,016
,, *Netherlands*	4,887	+ 2,960
,, *U.S.A.*	1,324	+ 159
Supersonic or electromagnetic echo-sounding apparatus and detectors	267	+ 90
From U.S.A.	38	− 7
Signalling and safety apparatus	323	+ 49
From Switzerland	126	+ 6
Elec. condensers	2,427	+ 1,168
From Netherlands	1,773	+ 934
,, *Switzerland*	460	+ 226
Current or voltage controlling, regulating or distributing apparatus	3,842	+ 1,573
From Switzerland	2,715	+ 922
Cable	875	+ 727
From Belgium	178	+ 99
,, *Netherlands*	500	+ 500
Insulated wire, flex, etc.	564	− 110
From Netherlands	187	+ 96
,, *Switzerland*	141	+ 58
Carbons, etc.	2,675	+ 1,879
From Switzerland	2,572	+ 1,909
Insulators	305	+ 60
From Switzerland	288	+ 157
Conduit, tubing, etc.	4	− 25
Elec. lamp bulbs and tubes	7,574	+ 1,578
From Netherlands	4,440	+ 1,300
Thermionic or electronic tubes and valves (not for lighting)	14,055	+ 4,100
From Netherlands	10,128	+ 3,456
,, *U.S.A.*	1,970	+ 865

* Comparative figures not available.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 9th February from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

7789. Cossor, Ltd., A. C.—Electromagnetic apparatus embodying laminations. 16th April, 1951. (723521.)

11682. Cossor, Ltd., A.C., and Sperry Gyroscope Co., Ltd. Generators for electrical oscillations. 9th August, 1951. Addition to 654,308. (723,308.)

1951

1257. English Electric Co., Ltd.—Tripping devices for electric circuit breakers. 11th January, 1952. (723526.)

12956. Siemens & Halske Akt.-Ges.—Electron microscopes. 31st May, 1951. (723772.)

13116. General Electric Co., Ltd.—Electromagnetic vibrators. 1st September, 1952. (723418.)

15229. Akt.-Ges für Bergbau- und Hüttenbedarf.—Electric motors. 27th June, 1951. (723319.)

16066. Cinema-Television, Ltd.—Vacuum-tight electrical connections for electron discharge devices. 4th July, 1952. (723320.)

16229. Johnson & Phillips, Ltd., and Stevens, C. J. H.—Sealing glands for use on electric cables. 24th June, 1952. (723623.)

16933. Standard Telephones & Cables, Ltd.—Electrical counting and like devices. 17th July, 1951. (723648.)

19640. Ferranti, Ltd.—Image projection systems, utilizing an intermediate film technique. 18th August, 1952. (723534.)

21477. Electro-Hydraulics, Ltd.—Control of electric motors driving battery-operated vehicles. 25th September, 1952. (723782.)

22220. Ferranti, Ltd.—Processes and apparatus for rendering electrostatic images visible. 15th September, 1952. (723539.)

22274. Standard Telephones & Cables, Ltd.—Electromagnetic light-current contact-making relays. 24th April, 1952. (723784.)

25070. Muirhead & Co., Ltd.—Control arrangements for photo-electric devices in facsimile apparatus and the like. 7th October, 1952. (723786.)

29643. Radio Corporation of America.—Cathode-ray tube apparatus. 18th December, 1951. (723436.)

1952

1192. Marconi's Wireless Telegraph Co., Ltd., and Buckingham, J.—Electrical converting circuit arrangements for the production of steady d.c. voltage. 27th November, 1952. (723794.)

1797. Jones & Co. (Engineers), Ltd., W.—Permanent magnet rotors for electrical machines. 7th January, 1953. (723795.)

2085. National Research Development Corporation, and Howells, G. A.—Pulse generating circuits. 27th April, 1953. (723331.)

2532. Cox, D. B.—Electric heating elements. 30th January, 1952. (723552.)

4243. Reyrolle & Co., Ltd., A.—Electric pilot wire circuit arrangements for protective or other purposes. 4th February, 1953. (723555.)

6687. Philips Electrical Industries, Ltd.—Control systems for electrical transformers. 14th March, 1952. (723801.)

7109. General Electric Co., Ltd., Brabham, H. B. S., and Ribchester, E.—Interference limiting circuits for television receivers. 6th March, 1953. (723446.)

7820. British Thomson-Houston Co., Ltd.—Waveguides. 16th March, 1953. (723741.)

7648. Pulse generating circuits. 17th March, 1953. (723803.)

8068. Welwyn Electrical Laboratories, Ltd.—Electrical condensers. 30th June, 1953. (723669.)

10004. General Electric Co., Ltd., and Judd, S. R.—Circuit arrangements including magnetic amplifiers. 16th June, 1953. (723567.)

10229. Air Preheater Corporation.—Voltage control in electrostatic precipitators. 23rd April, 1952. (723568.)

10370. Standard Telephones & Cables, Ltd.—Electromagnetic light-current contact-making relays. 24th April, 1952. (723806.)

10663. General Electric Co., Ltd., and Harrold, A. E.—Apparatus of the kind for giving an indication or affecting a control in dependence upon the difference in frequency for two oscillatory electric signals. 28th April, 1953. (723351.)

11144. Western Electric Co., Inc.—Signal translating devices utilizing semi-conductive bodies. 2nd May, 1952. (723808.)

12093. Pollopas Patents, Ltd. (Montrose-Oster, L. E. W.).—Electric motor driving arrangement. 13th May, 1953. (723678.)

13141. English Electric Co., Ltd.—Electromagnetic devices. 22nd May, 1953. (723570.)

14036. General Electric Co., Ltd., and Sherwen, J. W.—Vibratory conveyors and the like. 1st June, 1953. (723573.)

14116. Standard Coil Products Co.—Coil-winding machines. 4th June, 1952. (723684.)

14248. Office National d'Etudes et de Recherches Aeronautiques.—Apparatus for checking electric spot welding operations. 5th June, 1952. (723366.)

14341. General Electric Co., Ltd., and Vale, D. F.—Electrical appliances with pivoted handles particularly floor polishing machines and vacuum cleaners. 8th June, 1953. (723686.)

14594. Metropolitan-Vickers Electrical Co., Ltd.—Electric lighting installations employing fluorescent lamps. 14th May, 1953. (723746.)

14609. Storey, M. E. (personal representative of Storey, W. H., deceased), and Creed, F. G.—Production of electrical energy. 7th August, 1953. (723453.)

15013. Elliott Bros. (London), Ltd.—Waveguide junctions. 12th June, 1953. (723575.)

16986. Standard Telephones & Cables, Ltd.—Joint for an electric cable. 3rd July, 1953. (723457.)

17108. Barbany, A.—Fire detector made of two electric wires. 8th July, 1952. (723458.)

17626. General Electric Co., Ltd., Lee, R. D., and Pyle, G. C.—Apparatus for effecting amplitude modulation of electromagnetic energy. 13th July, 1953. (723583.)

17851. Dubilier, W.—Electrical capacitors. 15th July, 1953. (723693.)

18214. Standard Telephones & Cables, Ltd.—Circuit arrangement for the automatic storing and distribution of calls in trunk exchanges. 18th July, 1952. (723372.)

18799. Metropolitan-Vickers Electrical Co., Ltd.—Apparatus for indicating and/or controlling a dimension of articles moving in the direction of such dimension. 27th May, 1953. (723822.)

19052. Metropolitan - Vickers Electrical Co., Ltd.—Turbine rotors. 24th July, 1953. (723462.)

19394. Philco Corporation.—Colour television systems. 31st July, 1952. (723698.)

20386 & 20730. Evershed & Vignoles, Ltd.—Electrical controlling apparatus. 7th August, 1953. (723825/6.)

21170. Philips Electrical Industries, Ltd.—Electric-discharge tubes. 22nd August, 1952. (723384.)

22093. British Thomson-Houston Co., Ltd.—Variable unidirectional voltage sources. 26th August, 1953. (723596.)

22267. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Methods of producing electrically conductive mouldings from plastics. 4th September, 1952. (723598.)

22348. Uher, E.—Electrically driven flywheel starter. 5th September, 1952. (723599.)

22586. Young, F.—Shade retaining rings for electric ampholders. 20th August, 1953. (723601.)

22760. British Thomson-Houston Co., Ltd.—Electronic voltmeters. 10th September, 1953. (723472.)

23007. Tannoy, Ltd.—Moving coil loudspeakers. 20th October, 1953. (723604.)

23015. General Electric Co., Ltd.—Immersion electrodes for heating electrically conducting liquids. 8th September, 1953. Addition to 690693. (723605.)

23016. General Electric Co., Ltd., and Douglas, R. W.—Electric glass-melting furnaces. 31st August, 1953. (723606.)

23265. Jones & Co. (Engineers), Ltd., W.—Electricity supply systems. 16th September, 1953. (723608.)

23778. Dorman & Smith, Ltd.—Electromagnetic time delay units. 28th August, 1953. (723832.)

25562. Etablissements Merlin & Gerin.—Arc-extinction devices for electric circuit breakers. 13th October, 1952. Addition to 702834. (723837.)

26508. Wildfang, A. (trading as Metallwerke A. Wildfang Kommandit Ges.).—Electric flow water heaters. 22nd October, 1952. (723755.)

26584. C.J.R. Electrical & Electronic Development, Ltd., Banks, C. H., and Rimmer, G. M.—Speed control or indicating apparatus. 3rd July, 1953. (723839.)

26955/6. General Electric Co., Ltd., Tombs, N. C., and Lamb, W.—Manufacture of permanent magnets. 5th October, 1953. (723496/7.)

27474. General Electric Co., Ltd., and Williams, C. E.—Methods of testing the uniformity of the electrical resistivity over a conducting surface. 29th October, 1953. (723498.)

27660. British Dielectric Research, Ltd.—Manufacture of electric capacitors. 2nd November, 1953. (723841.)

28769. Western Electric Co., Inc.—Electron discharge devices. 14th November, 1952. (723504.)

28961. Philips Electrical Industries, Ltd.—Circuits for generating high direct voltages. 17th November, 1952. (723720.)

29478. Standard Telephones & Cables, Ltd.—Adjustable inductance coils. 13th November, 1953. (723846.)

29862. Rona, E.—Alternating current generators. 25th November, 1952. (723725.)

30181. Electric Storage Battery Co.—Electric storage batteries of the lead acid type. 28th November, 1952. (723614.)

31847. Philips Electrical Industries, Ltd.—Circuit arrangements comprising means for the periodic interruption of a current supplied to an inductance coil. 16th December, 1952. (723510.)

1953

10423. Philco Corporation.—Electrical synchronizing systems for cathode-ray tube apparatus, such as colour television receivers. 16th April, 1953. (723860.)

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 10th January, 1955

BIRMINGHAM.—Imperial Hotel, 6 p.m. I.E.E. South Midland Supply and Utilization Group. "A Brushless Variable-Speed Induction Motor," by Prof. F. C. Williams and E. R. Laithwaite.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Supply Group. "Supply to Industry," from the point of view of the consumer, by R. H. Cobbold; the commercial engineer, by W. P. Warren; and the distribution engineer, by J. S. Lombard.

DUNDEE.—Mathers Hotel, 7.30 p.m. Incorporated Plant Engineers, Dundee Branch. "Fans and Fan Engineering," by C. J. Atkins.

LEICESTER.—Demonstration Theatre, Electricity Offices, Charles Street, 7 p.m. Leicester Electrical Society. "Industrial Air Conditioning," by L. G. W. Gosden.

LIVERPOOL.—Royal Institution, Colquitt Street, 6.30 pm. I.E.E. Mersey and North Wales Centre. "The Economic Selection of Cooling Towers for Generating Stations," by G. F. Kennedy and P. H. Margen.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers, Informal meeting. Discussion on "Atmospheric Pollution," opened by G. R. Peterson.

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Utilization Group. "Design Performance and Application of Miniature Circuit Breakers," by H. W. Wolff and T. G. F. Atherton.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "Proving the Performance of Circuit Breakers with Particular Reference to those of Large Breaking Capacity," by J. Christie, H. Leyburn and J. F. Bird, "A New Research Station for High-Power Circuit Breakers," by J. Christie, H. Leyburn and R. W. Fenn, and "Design and Construction Features of a 275 kV Special Duty Transformer Bank," by E. C. Rippon.

Liberal Club, 98, Pilgrim Street, 6 p.m. North East Electrical Club. "The Lighter Side of Public Life," by Sir Edward Anderson.

SHEFFIELD.—Livesey Clegg House, 7.30 p.m. Junior Institution of Engineers, Sheffield and District Section. "The Heating of Houses," by James Law.

Tuesday, 11th January, 1955

BELFAST.—Queen's University, 6.30 p.m. I.E.E. Northern Ireland Centre. "Control and Protective Circuits for Small Self-Exciting Induction Generators," by J. R. W. Murland and R. L. Marrs.

EDINBURGH.—11, Atholl Crescent, 7.30 p.m. Edinburgh Electrical Society. "What is it?"

GLASGOW.—39, Elmbank Crescent, 7.30 p.m. I.E.E. South-West Scotland Students' Section. "Elements of Tape Recording," by P. I. Clare.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Students' Section. Centre chairman's address, by W. A. Crocker.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. "Electronic Switching and Common Control in Auto Exchanges," by T. H. Flowers.

At the Royal Society of Arts, John Adam Street, 6 p.m. Illuminating Engineering Society. "Fading and Related Effects Associated with the Radiation from Light Sources," by B. S. Cooper.

LOUGHBOROUGH.—The College, 6.30 p.m. I.E.E. East Midland Centre. "Heat Pumps," by J. A. Sumner.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "Automatic Circuit Reclosers," by G. F. Peirson, A. H. Pollard and N. Care.

Engineers' Club, 7.15 p.m. Incorporated Plant Engineers, Manchester Branch. "Pulverized Coal Firing for Lancashire Boilers," by V. Taylor.

NEWPORT, MON.—Flying Services Club, 28, High Street. Newport & District Electric Club. "The Growth of Generation of Electricity in South Wales," by H. J. Bennett.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. "Development and Utilization of Hydro-Electric Power in Uganda," by J. M. Stock and J. C. Lithgow.

Wednesday, 12th January, 1955

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Distortions and Transitions in the Atomic Nucleus," by Dr. C. Strachan.

BELFAST.—College of Technology, 7.30 p.m. Belfast Association of Engineers. "The Evolution of Mechanical Power Farming," by J. Chambers.

BIRMINGHAM.—James Watt Institute, 6.45 p.m. I.E.E. South Midland Students' Section. Students' Lecture. "Attitudes of Mind," by A. R. Cooper.

LEICESTER.—College of Art & Technology, The Newarkes, 6.30 p.m. Incorporated Plant Engineers, Leicester Branch. "Fans and Air Conditioning and Axial-Flow Fans," by R. H. Holbeche.

LIVERPOOL.—24, The Temple, Dale Street, Liverpool, 6 p.m. I.E.E. Mersey and North Wales Centre Joint Meeting with Liverpool Engineering Society. "A General Survey of Helicopters," by J. S. Shapiro.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. "Thermionic Valves of Improved Quality for Government and Industrial Purposes," by E. G. Rowe, P. Welch and W. W. Wright.

Northmet House, Southgate, N.14, 3 p.m. E.I.B.A. North Metropolitan Branch. Annual general meeting.

MANCHESTER. — Electrical Engineering Building, The University, 6.45 p.m. I.E.E. North-Western Radio Group. "Surface Waves," by Dr. A. L. Cullen.

NEWCASTLE-UPON-TYNE. — Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North-Eastern Section. Address by the president, Rear-Admiral (L) Sir Philip Clarke.

NORTHAMPTON.—College of Technology, 7.15 p.m. Northampton & District Electrical Association. "Power Station Instrumentation," by G. Oldroyd.

OXFORD.—37, George Street, 7 p.m. I.E.E. district meeting. "The Future of Electronics in Industry," by E. R. Davies.

SOUTHAMPTON.—The University, 6.30 p.m. I.E.E. Southern Centre. "Mechanical Aspects of Aircraft Generation Equipment," by W. R. Hinton.

TREFOREST.—Glamorgan Technical College, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. "Electronic Counting Devices," by Dr. F. H. Gage.

WOLVERHAMPTON. — Technical College, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. "Electronics in Materials Handling," by L. Landon Goodman.

Thursday, 13th January, 1955

CARDIFF.—Institute Buildings, Park Place, 6 p.m. South Wales Institute of Engineers. "The Assessment of Noise at Collieries," by W. H. Powell.

DERBY.—Electricity Showrooms, Irongate, 7 p.m. Derby Electrical Society. "Industrial Electric Furnaces," by E. May.

DUNDEE.—University College, 7 p.m. I.E.E. North Scotland Sub-Centre. "Distortions and Transitions in the Atomic Nucleus," by Dr. C. Strachan.

EXETER.—Rougemont Hotel, 3 p.m. I.E.E. South Western Sub-Centre. "Some Design Features of the Semi-Outdoor Power Station at Ince," by F. H. S. Brown. Visit of vice-president, Sir George Nelson.

GLASGOW.—At the Institution of Engineers & Shipbuilders, Elmbank Crescent, 7 p.m. British Institution of Radio Engineers, Scottish Section. Discussion on "Channel III Commercial Television."

HULL.—Y.E.B., Ferensway, 7.15 p.m. I.E.E. North Midland Centre, district meeting. Centre chairman's address.

LONDON.—At the Institution of Civil Engineers, Great George Street, 5.30 p.m. Institute of Fuel. "Integration in the Iron and Steel Industry," by W. F. Cartwright.

NEWCASTLE-UPON-TYNE.—Lecture Theatre, Carliol House, 3 p.m. E.I.B.A., Northern Counties Area. Annual general meeting.

SWANSEA.—South Wales Electricity Board's Showrooms, The Kingsway, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. "The Possibilities of a Cross-Channel Power Link between the British and French Supply Systems," by D. P. Sayers.

Friday, 14th January, 1955

BIRMINGHAM. — Midland Hotel. I.E.S. Birmingham Branch. Annual dinner.

STOKE-ON-TRENT.—Electricity Showrooms, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Development and Utilization of Hydro-Electric Power in Uganda," by J. M. Stock and J. C. Lithgow

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 15th January.

No. 723,706 (design), Class 9. Electronic apparatus and parts thereof; and sound records.—Westminster Recording Co., Inc., New York, U.S.A. Address for service, c/o A. A. Thornton & Co., Napier House, 24–27, High Holborn, W.C.1.

MIPOR (design). No. 732,602, Class 9. Electric accumulators and storage batteries and parts.—Accumulatoren-Fabrik Akt.-Ges., Frankfurt am Main, Germany. Address for service, c/o Edward Evans & Co., 14–18, High Holborn, London, W.C.1.

EXAL. No. B732,974, Class 9. Scientific apparatus and instruments and parts and fittings. EXAL. No. B732,975, Class 10. X-ray apparatus; surgical, medical, dental and veterinary apparatus; and parts and fittings.—Electronic & X-Ray Applications, Ltd., 13–17, Pennant Mews, Kensington, W.8.

HIFIMATIC. No. 733,664, Class 9. Tuning devices for television receivers.—Hifi, Ltd., Derry Works, Derry Street, Brierley Hill, Staffs.

GOLDEN LYRE. No. 733,840, Class 9. Radio apparatus; television apparatus, etc.—Mercury Record Corporation, Chicago, U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5–9, Quality Court, Chancery Lane, London, W.C.2.

ECTONUS. No. 735,053, Class 10. Electromedical apparatus for use in the treatment of mental disorders.—R. J. Russell, Three Counties Hospital, Arlesley, Beds.

BESCOL (design). No. 732,514, Class 11. Electric space heaters.—Bescol (Electric), Ltd., 118, Parkfield Road, Saltley, Birmingham.

GENERATION and DEVELOPMENT

Recent B.E.A. Contracts

Contracts have been placed by the British Electricity Authority during the past month for power stations amounting in the aggregate to £1,344,900. They include the following:—

Goldington power station, Bedford: Three cooling towers.—Film Cooling Towers (1925). 11 kV and lower voltage cables and accessories.—Malcolm & Allen.

Nottingham power station: One 30 MVA interbus transformer and rewinding of two existing 30 MVA transformers.—Hackbridge & Hewittic Electric Co.

Willington "A" power station, near Derby: One 106 MVA 275 kV generator transformer.—English Electric Co.

Ferrybridge "B" power station, Yorks: Structural steelwork.—United Steel Structural Co.

Barony power station, Ayr: Superstructures for main and other buildings.—John Laing & Son.

Dalmarnock power station, Glasgow: High pressure pipework and valves.—Stewarts & Lloyds.

District Reorganization

In the Merseyside and North Wales Electricity Board's No. 4 Sub-Area, which covers the six North Wales counties and parts of Cardiganshire, Shropshire and Cheshire, a considerable extension of supply has taken place during the past few years. The Sub-Area covers 3,989 square miles, and the Board has now decided to reconstitute the present District organization by placing each of the eight Districts in this Sub-Area under the supervision of a district manager.

At the present time, it is not intended to alter the boundaries of the existing Districts, and the posts of district engineer and district commercial officer will remain in being. The Districts concerned are Wrexham, Crewe, Rhuddlan, Conway, Caernarvon, Oswestry, Anglesey and Aberystwyth.

East Midlands Topics

Although the cost of electricity purchased had increased during the past six years by no less than 72 per cent, the average price received by the East Midlands Electricity Board from all consumers had risen only 13 per cent. This was one of the points made by Mr. C. W. Flint, chief accountant, in reviewing the Board's accounts at a meeting of the Electricity Consultative Council in Nottingham on 29th December. He said that to carry out its large development programme the Board had spent on capital account over £26 million since vesting day. For depreciation of assets, the provision made annually by the Board had almost doubled since 1949. Last year £2,300,000 had been earmarked for depreciation, which represented 37 per cent of the capital expenditure in that year. If capital expenditure continued at the same rate, the annual provision for depreciation would reach £3 million in about four years' time, or almost 46 per cent of the annual capital expenditure. In reply to a question Mr. Flint said he thought it would be a retrograde step to go back to giving discounts for prompt payment of electricity accounts.

Details were submitted of the revised hire-purchase terms recently introduced by the Board and the Council was pleased to note that the views of its local committees had been taken into consideration. Mrs. Oxenham expressed the opinion that as washing machines were necessities the purchase tax on them should be removed.

New schemes being undertaken by the Board involve a total expenditure of £443,445, which includes supplies to 2,544 new houses estimated to cost £161,124; reinforcement and voltage standardization £112,602; industrial supplies £52,409; rural development (319 farms and other premises) £90,880; and eight other schemes £26,430.

Submarine Cable Breakdown

The Quebec Correspondent of the "Financial Times" reports that the submarine power cable across the St. Lawrence River from Manicouagan to Les Boules, which was brought into use on 1st December, failed five days later. It is believed that repair work may not be finished until the spring.

Trinidad Electricity Strike

After the Port of Spain Electricity Board had informed the Governor of Trinidad that it could no longer guarantee a supply because of a three-day-old electricity strike, the Governor proclaimed a state of emergency and issued an ordinance authorizing the Trinidad Electricity Commission to take over the distribution system. The Port of Spain correspondent of "The Times," reporting this, says that the Board promised the workers wage increases totalling, with back pay, $235,000, which it could not meet from its own funds, and which the Government could not authorize except with the approval of the Legislative Council, which is in recess until 14th January.

Mucomir Project

To augment supplies of electricity in Fort William and the surrounding district, a scheme prepared by the North of Scotland Hydro-Electric Board has been confirmed by the Secretary of State for Scotland (Mr. James Stuart).

Water will be led from the Mucomir Cut (an artificial channel constructed when the Caledonian Canal was built) by a short tunnel to a 1,500 kW generating station on the north bank of the River Lochy. A fish pass will be provided to allow the salmon to reach Loch Lochy. The scheme is estimated to cost £375,000 and will produce 9 million kWh a year.

Shira Power Scheme

Speaking during a Press visit to the Glen Shira hydro-electric scheme on 22nd December, Mr. T. Lawrie, C.B.E., general manager of the North of Scotland Hydro-Electric Board, said that there were three points of particular technical interest in the scheme. First, the 40 MW turbo-alternator in the Clachan power station was the largest in the Board's present programme; secondly, instead of having a pipeline down the hillside at Clachan, there was a sloping pressure shaft or "buried pipeline" inside the hill working under a pressure head of 965ft of water, which was by far the highest of any of the Board's pressure shafts; thirdly, the upper power station at Sron Mor was a reversible pumping station, which would either generate electricity from the water in the main dam or pump surplus water back in times of wet weather from the lower dam to the main dam where it could be stored for future use in times of dry weather. This pump storage scheme, which was of 5 MW capacity, was the first which the Board had undertaken and the first in the country except for a small industrial one established some time ago at Walkerburn on the Tweed. Like Sloy, the Shira scheme was designed for peak load operation but naturally when it was wetter than usual the fullest use would be made of the rainfall with consequent benefit in the saving of coal at steam power stations. Work had been going on steadily at Glen Shira for the last six years and very soon now the plant would be in production.

European Electricity Costs

M. Louis Armand, Director-General of the French National Railways, has agreed, with the approval of the French Government, to carry out an inquiry, on behalf of the Organization for European Economic Co-operation, on electricity production problems in Europe. Concern is felt by the O.E.E.C. about the possible effects of a continued rise in electricity production costs on the financial stability of member countries and the living standards of their populations. It is likely that the inquiry will take several months to complete.

North Wales "Defence"

About forty owners and tenants of land in the Cwm Rheidol district of North Wales have formed a "defence association" upon receiving notices of compulsory purchase from the British Electricity Authority. The chairman of the association, Mr. F. Daniel, is reported by the "Manchester Guardian" to have said that they did not object to the B.E.A.'s hydro-electric scheme in principle, but sought a reduction in the extravagant size of the area now subject to compulsory purchase. He complained, too, that the B.E.A. had shown a lack of candour and consideration.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—25th February. Brisbane City Council. 33,000 V ganged airbreak switches. (E.S.B. 29509/54. Ten/11928.)*

Ayr.—County Council. Street lighting, New Cumnock. (See this issue.)

Bedlington (Northumberland). — 29th January. U.D.C. Twelve months' supply of electrical goods in connection with the Council's housing programme. A. K. Dennis, surveyor, Council Offices.

Belfast.—28th January. Corporation Electricity Department. Stores. (See this issue.)

Belper.—16th February. U.D.C. Six sets of sewage pumping plant, with motors, starters, switchgear, etc. C. J. Lomax & Son, consulting engineers, 37, Cross Street, Manchester, 2.

Burma.—18th January. Electricity Supply Board. Thirty-five electrically driven pumping sets for the Balu Chaung hydro-electric project. (E.S.B. 29629/54. Ten/11933.)*

Cockermouth.—19th January. U.D.C. Street lighting equipment. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. 132 kV and 11 kV switchgear for St. Fillans power station. (See this issue.) Outdoor 33 kV switchgear for Dalchonzie substation. (See this issue.)

Hackney.—26th January. Borough Council. Stores, including lamps for street lighting. (See this issue.)

Hawick.—14th February. Burgh Council. Street lighting equipment. (See this issue.)

Huddersfield.—31st January. Town Council. Electric lamps and cables for one year. Forms No. 17, 18 and 19 from the borough surveyor, High Street Buildings.

India.—7th March. Electrical and Mechanical Division, Government of Andhra Electricity Department, Madras. Additional indoor and outdoor switchgear for Kurnool and other 66 kV substations. (E.S.B. 29816/54. Ten/11969.)*

Irish Republic.—29th January. Louth County Council. Electrically operated pumping units. (E.S.B. 29480/54. Ten/11950.)*

Kuwait.—18th March. Government Department of Electricity. Indoor type 33 kV metalclad switchgear, control room equipment and alternator pit equipment. (See this issue.)

Marlborough.—1st February. Borough Council. Group "A" street lighting installation. (See this issue.)

New Zealand.—19th April. State Hydro-Electric Department. Eleven 220 kV, three-phase air-break switches. (E.S.B. 29739/54. Ten/11957.)* 26th April. Five 220 kV, 2,500 MVA, three-phase circuit breakers. (E.S.B. 29740/54. Ten/11961.)*

15th February. Post and Telegraph Department, Wellington. Fuse mountings. (E.S.B. 29548/54. Ten/11935.)* 22nd February. Electrical instruments. (E.S.B. 29549/54. Ten/11943.)* 24th February. Independent sideband transmitter. (E.S.B. 29550/54. Ten/11934.)*

Portuguese East Africa.—5th February. Permanent Purchasing Commission, Lourenço Marques. Equipment for pumping station for the supply of cooling water to new power station. (E.S.B. 29817/54. Ten/12000.)*

South Africa.—20th January. Union Tender and Supplies Board, Pretoria. Radio valves. (E.S.B. 29885/54. Ten/11960.)*

Department of Posts and Telegraphs, Pretoria. Firms wishing to be included in a proposed list of approved tenderers for p.v.c. switchboard cable should apply to P.O. Box 447, Pretoria, as soon as possible. (E.S.B. 9782/54. Gen/1664.)*

Spain.—15th January. Carbones De Berga S.A., Barcelona. 500 electric safety headlamps for miners. (E.S.B. 30125/54. Ten/12040.)*

Swansea.—5th February. Borough Council. Electric lamps for one year. Borough surveyor, Guildhall.

United States.—10th January. Department of the Interior Bonneville Power Administration, Portland, Oregon. Auto transformers. (E.S.B. 29574/54. Ten/11937.)*

1st February. Corps of Engineers, Seattle. Six 67,368 kVA a.c. generators for the Chief Joseph Dam power house. (E.S.B. 29904/54. Ten/11957.)*

Uruguay.—24th January. Administracion de Ferrocarriles del Estado. Reactors and starters for fluorescent lighting. (E.S.B. 29945/54. Ten/11986.)*

Wanstead and Woodford.—21st January. Town Council. Street lighting. (See this issue.)

Worthing.—19th January. Corporation. Street lighting equipment. (See this issue.)

ORDERS PLACED

Llandudno.—U.D.C. Accepted. 22 Class "A" and 136 Class "B" concrete street lighting columns with lanterns (£3,655).—G.E.C.

Preston.—Corporation. Electrical installation, Eldon Street County Primary School (£1,272).—R. A. Ranson, Blackburn.

Sheffield.—Regional Hospital Board. Rewiring of the Newholme Hospital at Bakewell, Notts (£2,060).—T. W. Sampson & Co.

South Shields.—Corporation. Alternator (£592) and one salient-pole synchronous motor (£915) for South Shields Grammar and Technical School for Boys.—A. Reyrolle & Co., Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashton-under-Lyne.—Central garage and buildings for administration, etc. (£41,000); A. T. Kemp, borough surveyor, Municipal Buildings.

Barnsley.—Rebuilding Gaumont Cinema, Eldon Street, for Circuits Management Association, Ltd.; Sir Alfred McAlpine, Ltd., Little Sutton, Wirral, Cheshire.

Bebington.—Stage one of scheme for new town hall; Willink & Dod, architects to Council, Cunard Building, Liverpool.

Bedfordshire.—County primary school, Putnoe estate, Goldington (£91,500) and police station, Ampthill (£29,300); S. V. Goodman, county architect, Shire Hall, Bedford.

Birkenhead.—Block of offices for Corporation departments; borough architect, Wexford Road.

Bradford.—Extensions to works and offices at Lidget Green, for Field & Sons Co., Ltd.; Wm. Shackleton, architect, 23, Hallfield Drive, Baildon.

Brighton.—Flats and maisonnettes on site in Essex Street (£58,550), and flats on the Upper Bedford Street-Somerset Street site (£79,100); borough surveyor, 26/30, King's Road.

Burton-on-Trent.—Flats (40), with laundry, on the Manners estate; H. B. Chapman, town clerk, Town Hall.

Canvey Island.—Sixty-seven acre housing estate; Walthamstow B.C., Town Hall, Forest Road, London, E.17.

Carlisle.—Eight shops and flats at Harraby, 31 bungalows at Shady Grove Road, 100 traditional houses at Morton, and 24 bungalows and 16 flats at Morton for the City Council; city engineer, 18, Fisher Street.

Chelmsford.—Large extensions to Mid-Essex Technical College and School of Art (£173,000) for County E.C.; H. Conolly, county architect, County Hall.

Dagenham.—Service depot, Chequers Lane; Samuel Williams & Sons, Ltd., Dagenham Dock.

Factory, Hainault estate; Advance Components, Ltd., Back Road, London, E.17.

Derbyshire.—Fifteen schools as programme for 1955/6; county architect, County Offices, St. Mary's Gate, Derby

Dewsbury.—Houses (110), on Overthorpe Road estate; borough surveyor, Municipal Buildings, Halifax Road.

Dudley.—Houses (84), on Windmill End estate; F. H. Gibbons, borough surveyor, Council House.

Gateshead.—Eleven blocks of eight-storey flats for the T.C. (£958,000); Wimpey and Co., Ltd., contractors, Orchard House, Jesmond, Newcastle-on-Tyne.

Greenwich.—Modernization of wards, St. Alfege's Hospital; South East Metropolitan Regional Hospital Board, 11, Portland Place, W.1.

Harrow.—St. Andrew's Church, Roxbourne; Cyril A. Farey, Son & Adams, architects, 83, Prince Albert Road, N.W.8.

Dwellings (24), Headstone Lane; Comben & Wakeling, Ltd., 603, Kenton Road, Kenton.

Kingsbury.—Factory, Honeyport Lane; Kestrel Engineering Co., Ltd., Scrubs Lane, London, N.W.10.

Kingsclere and Whitchurch.—Houses (119), in several parishes; R.D.C. surveyor.

Lambeth.—Crematorium for borough cemetery; borough engineer.

Mayfair.—Headquarters, Devonshire Place; Royal Society for Prevention of Accidents, 52, Grosvenor Gardens, S.W.1.

Millwall.—Warehouse, Thomas Road; Mazawattee Tea Co., Ltd., 52, Leadenhall Street, E.C.3.

Newcastle-on-Tyne. — Rebuilding the Apollo Cinema, Shields Road, for Tyne Picture Houses, Ltd.; Stanley Miller, Ltd., builders, 17, North Street.

Houses (68), on the Kenton North estate for the City Council; Newcastle and District Building Trade Employers' Association, contractors.

Erection of five-storey flats in the Scotswood clearance area for the City Council; city architect, 18, Cloth Market.

Stroud.—Houses (52), on site at Minchinhampton for R.D.C.; surveyor, Rural Council Offices.

Sunderland.—Houses (51), for the T.C.; George Henderson, builder, Moor Lane, East Boldon.

Wallsend.—R.C. church and presbytery, High Farm; Stienlet and Son, architects, 4, Queen's Square, Newcastle-on-Tyne.

Houses (32) and community centre; G. Teasdale, borough surveyor.

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* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).